Volume 60 American Machinist Number 22

New York, May 29, 1924

If the Great War proved anything, it was that industrial mobilization is vital to ultimate victory. Ordnance and munition manufacture differ from peace time production in certain particulars but are equally dependent upon an adequate supply of accurate gages. That gages are a basic requirement is recognized by those responsible for the Ordnance Department program. General Williams, who is well known to readers of the AMERICAN MACHINIST, *tells here of the plans for solving the gage problem.*

Gage Problems of the Ordnance Department

By Maj. Gen. C. C. Williams
Chief of Ordnance

THE outbreak of the World War found the Ordnance Department faced with many staggering problems. Among them was the pressing necessity for munitions in abundance, and, since ordinance materiel is non-commercial in nature, the lack of knowledge on the part of commercial industry added to the task. The quantities required were also of such enormous proportions that it was mandatory that the articles to be produced be broken up into their components and distributed over a wide field of commercial producers. This distribution of components, and their subsequent assembly at some central point, called for absolute interchangeability of all parts. On the surface, it would seem that interchangeability, an outstanding factor in ordinary American commercial quantity production, would not present much of a problem to resourceful manufacturers. The contrary was true. It was difficult to secure interchangeable manufacture. Gages and the personnel to make them proved to be the deficient elements.

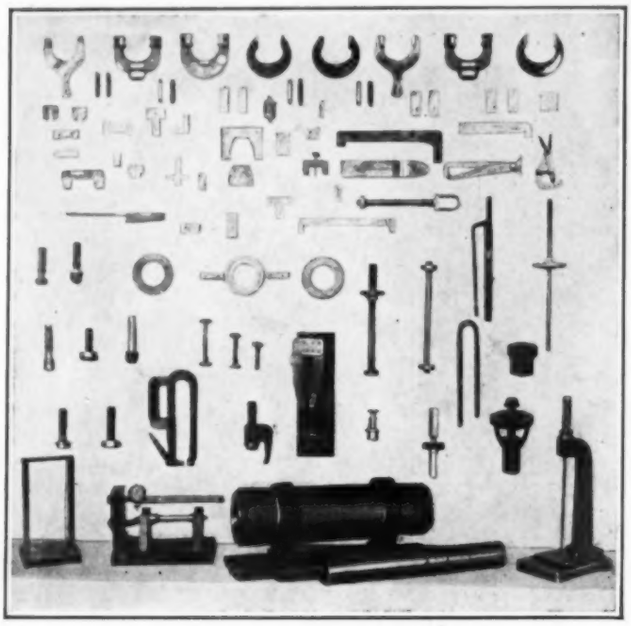
Before considering gages and their fabrication, it is necessary to point out that the characteristics of the necessary gages depend in their turn on proper tolerances and allowances on the drawings. Gages measure the product and insure that the article conforms to the drawings. We adopted French and other foreign designs during the war and of course received from our allies the drawings for their material. Interchangeability is not a feature of foreign manufacture and little account was taken on these drawings of tolerances and allowances. It became necessary for us not only to convert the measurements from the metric to the English system, but to figure tolerances as well in order that interchangeable manufacture would be possible. This took time, and since time is the essence in war, delays ensued which became critical to the proper supply of our troops at the Front.

We also learned early in the war that the fabrication of the gages necessary would be a difficult matter. Gage-making is the highest form of tool-making. In fact, it is an art requiring many years of experience for its development in the individual. Under the conditions, the number of gage makers is small. Further, the time required for training practically precluded an increase in numbers during the war. The small number available at the outset of war must carry the whole burden of producing these important adjuncts to manufacture.

The war found the Ordnance Department in need of thousands of gages with a relatively small number of men qualified to make them. The gage program approached $100,000,000 in money. We could have used the total number of gage-makers for Ordnance gages alone. But, of course, the available number had to be spread throughout all industry necessary for the conduct of war and we could not count on such a proposition.

The problem was too large to permit time for experi-

ment. We hit on the expedient of having each contractor make his own gages and also, where possible, make inspection sets for use by the government inspectors. Of course, we checked these contractor's gages to insure their correctness. A bad feature of this scheme was the fact that the best tool-makers had to be withdrawn from production work for gage making. Another natural result was that design of gages for the most efficient and economical inspection of materiel was a hurried process. There was lack of uniformity



A set of gages for 75-mm. shell

and no control of the designs. A loss of time and a waste of considerable sums in remedying basic errors in gage manufacture followed from this lack of plan for gage production. The whole situation may be summed up as a failure to appreciate the difficulty of procuring gages, especially in time of war when industrial effort in all its phases is intensified.

The lessons learned under the pressure of war have been capitalized for our future guidance. The first step taken was the organization of a gage section in the Ordnance Department to assume charge of all matters pertaining to the design, storage, procurement, and issue of gages. This section has a controlling office in Washington and gage laboratories in each manufacturing arsenal. In time of war, it is the plan to control design, procurement, and other functions from the Washington office and to delegate gage checking, storage, issue, and other physical operations to the gage laboratories. In this way, it is hoped to secure uniformity of design and the most efficient employment of the gages produced for us during a war of the future by the prominent gage-making concerns of the country.

Safeguarding Gages on Hand

We have at present a considerable number of gages which became the property of the Ordnance Department under contract settlements after the World War. The value of these gages is about $35,000,000. Considerable care has been exercised in safe-guarding and classifying them, since we feel that they furnish an excellent war reserve which can be issued in the event of an emergency to manufacturers until more gages can be produced. All of these gages have been segregated in the gage laboratories of the government arsenal where the materiel to which the gages pertain is produced. Careful inspection has been made and every gage has been classified with reference to the component served. Accuracy tests have also been accomplished. For permanent storage, it has been necessary to slush with grease, wrap in moisture-proof paper, and segregate to special racks, bins and trays. Because of the large number involved, an adequate record system is necessary. Four cards are made for each gage, two of which remain in the laboratory file and the other two go to Washington for the master file of all gages.

Studying Allowances and Tolerances

In addition to the work incident to the storage, issue, and classification of the large stock of gages now on hand, the Gage Section has also found it necessary to go into the question of tolerances and allowances—a subject much in need of serious attention. After considerable study, it was finally decided to adopt the so-called one-way unilateral system of tolerances and allowances, and this system is now in use on all new drawings of the Ordnance Department. It is worthy of note that this adoption brings us more into line with the best commercial practice. Both the National Screw Thread Commission and the Plain Gage Committee for cylindrical engineering work appointed by the various engineering societies, have decided on this system and have recommended to industry that unilateral tolerance only be used.

The Gage Section has given much attention to the standardization of gage designs, in order that gages may be produced with the minimum amount of high grade labor and at the same time to give greater life when put into actual use. This work should prove of great value in the event of another emergency, both in the saving of time and money, and the redesigning of gages is one of the most important functions of the Gage Section at the present time.

The Gage Section also has under way an investigation into the kind of steel which should be used in making gages. The problem proposed is that of securing the maximum wear resistance, the reduction of dimensional changes in the hardening process, and, so far as possible, the elimination of dimensional changes in time. There was little information on these subjects to aid in their solution, and experimental work remained the only alternative. It is a commonly recognized fact that the average thread gage about one inch in diameter will inspect about 5,000 pieces. With this knowledge, the Ordnance Department had three gages of the same dimensions made for test. The steel used was carefully selected for physical and chemical properties thought best suited for the test and a definite heat treatment was prescribed. A wear test of all three gages was then carried out under actual conditions at an arsenal. The results were gratifying. We had found a suitable gage steel. Each gage inspected over 13,000 pieces with a wear equal to only one-half of the wear tolerances. Under such conditions, each of these gages should be good for at least 10,000 more pieces. The wear resistance has been quadrupled by this experiment. It is needless to point out the advantages of increasing the wear resistance when one considers the cost and difficulty of making a gage. The complete

history of this steel and heat treatment is recorded and can be reproduced.

In some cases, the tolerances prescribed on drawings are very close, especially where great accuracy is required. With gages made under such conditions, and particularly when the volume of original raw materials is large, a seasoning process which lengthens the production time is necessary. Seasoning is accomplished by laying the gage aside for a time between cuts. The longer the time between cuts, the less will the gage be subject to changes affecting accuracy after it is completed. The Gage Section carries on a constant study to liberate tolerances as much as possible in order that the seasoning period may be shortened. By such study, it is expected that appreciable reductions in time to manufacture will be accomplished, thus increasing the output in time of war.

Multiplicity of Gages Needed

The number of gages required for the various steps in Ordnance manufacture complicates the problem of securing gages in time of war. The accompanying photograph indicates the different gages required for the manufacture of 75-mm. shell. There are seventy-seven gages in this picture. But the picture only indicates the variety. For the quantity production of 4,000,000 shells a month, necessary for a major war, a large number of each type would have to be made. However, the 75-mm. shell is by no means the article requiring the greatest variety of gages. The following items, for example, call for gage combinations as indicated opposite each:

Item	Number of Gages
30 caliber Springfield Rifle, Model 1903	1263
Browning Machine Gun, Model 1917	2262
75-mm. Recuperator	597

Gage supply, in our opinion, is vital to the problem of obtaining production in time of war. As much as possible should be done in time of peace to insure the early production of gages. The National Defense Act of 1920 takes this problem into account in one section prescribing the development in time of peace of a stock of gages and other essential equipment for war manufacture. Each year, the Ordnance Department requests funds from Congress for the development of a gage reserve. The Appropriation Bill for 1925 carries an item of $50,000 for gage development. As time goes on, it is hoped to secure other sums from Congress which will be applied toward rounding out the reserve of gages necessary for the manufacture of items essential for the carrying on of war. Relatively small amounts spent now will be amply repaid by more rapid munitions production in time of war. Rapid munitions production, insuring that early preponderance of arms and ammunition which exercises such a controlling effect on the outcome of modern warfare, can be accomplished in large measure by complete readiness to provide with a minimum of delay sufficient quantities of properly designed gages. Without such gages, quantity interchangeable manufacture would be impossible.

It is my fixed belief that the gage problem is one of outstanding importance in the preparedness plans of this country and one that must be worked out in time of peace in order to prevent undue delay and large waste of the public money in an emergency.

Rolling Threads on Thin Brass Shells

By W. P. Doolittle

When rolling threads on thin brass shells, considerable trouble is experienced in holding the work to plug, or ring, thread-gage. Some of the troubles are due to the shell being drawn to incorrect diameter; to the fact that allowance has not been made for the thickness of shell wall on the threading roll and arbor; and to a variation in the temper of the shell metal.

Making the shell diameter too large or too small in the sizing operation preceding the threading, is probably the most general cause of poor-fitting screw shells. In case the shell diameter is too small, it is possible to correct it to some extent, by setting the threading tools so that they will pinch the shell, thereby thinning the metal and spinning the shell to a larger diameter. In case the shell is too large before the threading operation, it is more difficult to correct it The writer has seen some instances where the shell was too large after threading, and required a special sizing operation. This was performed by forcing the threaded shell into a die, the diameter of which was somewhat smaller than the outside diameter of the threaded shell.

Not allowing for thickness of the shell wall on the threading roll and arbor, can be corrected by making the tools fit the work.

Variation in the temper of shell metal will give very little bother after the correct diameter of drawn shell is once obtained, as the temper usually runs uniform under similar conditions.

Diameter Affected by Hardness

Shells of a different hardness or temper, even though they are the same diameter before rolling, will have threads of different diameter when rolled; the harder the shell, the larger the thread diameter. A shell with open ends, as shown in Fig. 1, will enlarge more than the shell shown in Fig. 2. The shell shown in Fig. 3, if rolled on a straight arbor, will be tapered, the largest part being at the open end. To roll this shell so it will be the same diameter at both ends, the arbor is made tapered as shown at *A*, Fig. 4. The bottom of the shell is supported by the back chuck *B*. It is also necessary to make the roll tapered to suit the arbor, unless the threading machine is equipped with a swivel roll holder. This method holds good only on short shells.

The shell shown in Fig. 5 fits over another shell, therefore it is necessary to increase the diameter at *A* by the amount the thread will enlarge the inner shell. This shell will not enlarge as much, due to thread rolling, as the shell shown at Fig. 1, owing to the fact that it is restrained at one end of the thread by the bottom and at the other end by the flange.

The surest way to determine the amount the thread rolling will increase the diameter of the thread over the shell diameter, is the cut and try method. The writer has, however, used the following method with fair success for rounded threads, where the depth of thread is from 0.25 to 0.3 times the pitch. For open-end shells, as shown in Fig. 1, where the hardness reading on the scleroscope equals 13, $X = D\ 0.25$; hardness reading 18, $X = D\ 0.33$; hardness reading 24, $X = D\ 0.5$. For closed end shells similar to Fig. 2 with a hardness read-

ing of 13, $X = D\ 0.1$; hardness reading 18, $X = D\ 0.2$; and hardness reading 24, $X = D\ 0.3$ In the above formulas X equals the difference in diameter between the drawn shell and the same shell after threading, and D equals the depth of thread.

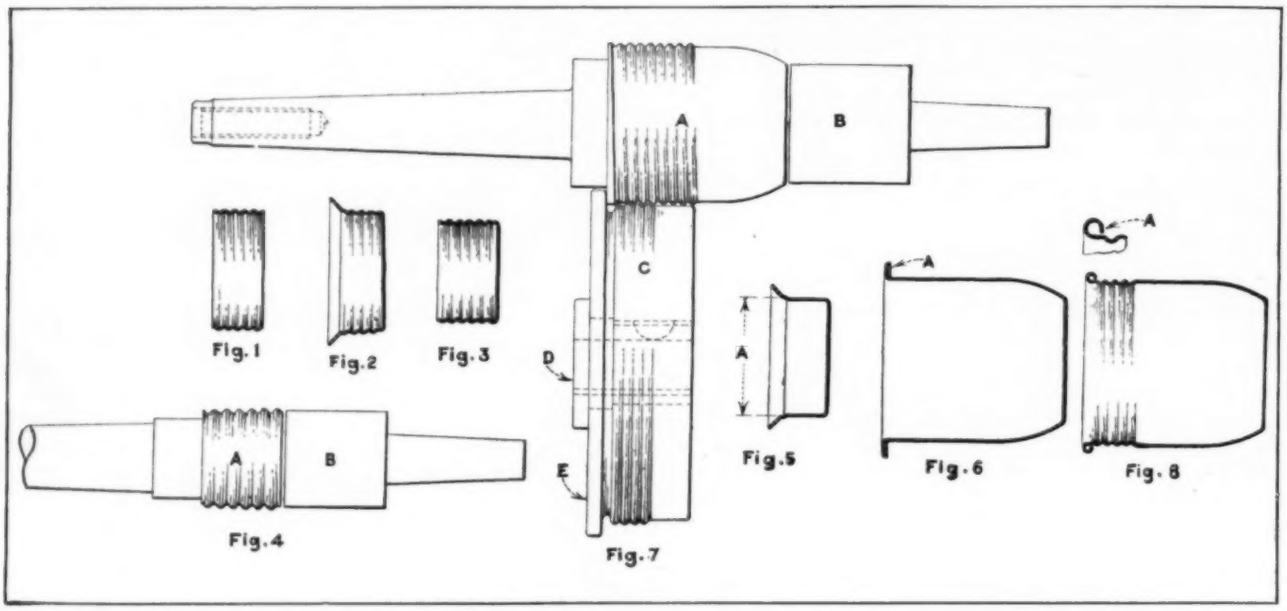
It must be borne in mind that metals of different composition, but of the same hardness, will give different readings on the scleroscope. For instnace brass with a high copper content may be softer than brass with less copper content, but still give a higher hardness reading. The hardness reading, 13, used above, is for a brass shell, blued; the readings 18 and 24, cover the hardness of unannealed brass after the sizing or drawing operation. The formulas given do not apply to the shell shown at Fig. 6, as the body of this shell is supported on the extended threads of the arbor at the closed end and by the unthreaded part at the open end. The roll threading will not, therefore, increase the diameter of the shell.

Where two threaded shells are to be made, one to screw inside the other, it is good practice to draw the outside diameter of the internal shell 0.006 to 0.008 in. less than the inside diameter of the external shell, where the hardness of both shells is the same.

It is considered the best practice to make the diameter of the threading arbor about 0.004 in. less than the inside diameter of the shell, although fair results can be obtained by making the arbor small enough so that the shell will slip off after the threading operation, unless the wall of the shell is very thin. In the former case, it is necessary that the direction of rotation of the threading arbor be such that the work can be screwed off without stopping the machine, otherwise some other means must be provided for unthreading the work from the arbor.

When the pitch diameter of the threading roll equals the pitch diameter of a single threaded shell, it should have a single thread. If twice the diameter of the shell, it should have a double thread, and if three times the diameter of the shell, a triple thread and so on. The pitch diameter of the threading roll should be figured from the pitch diameter of threaded shell and not from the arbor. For rolling a right hand thread on a shell, it is necessary to cut a left hand thread on the roll.

Regarding the setting of tools, the roll should be set so that it will roll, or form, the metal on the arbor to the full depth of thread without pinching. Pinching the metal will enlarge the shell and is often resorted to when the drawn shell is too small, in order to make it fit the gage.



Figs. 1 and 2—Shells that will be enlarged in thread rolling. Fig. 3—A shell that will be taper if rolled on a straight arbor. Fig. 4—Tools for threading the shell shown in Fig. 3. Fig. 5—A shell that is to fit over another shell. Fig. 6—Shell flanged for curling. Fig. 7—Tools for threading and curling the shell shown in Fig. 6. Fig. 8—Shell shown in Fig. 6, curled and threaded

Tools for Thread Rolling and Beading

There is shown in Fig. 7, a set of tools for use in a Waterbury Farrell Foundry and Machine Co.'s thread rolling machine, for roll threading and curling the bead on the shell shown in Fig. 6. Fig. 8 shows the shell after the roll-threading and curling operation. Referring to Fig. 7, A is the thread arbor, B the back chuck, C the thread roll, the pitch diameter of which is twice that of the shell and which has a double thread so as to keep the lead the same as the shell thread. The bushing D is keyed to the roll C and also to the shaft. The shaft is geared to the main spindle of the machine, so that it makes one revolution to two of the main spindle. The curling roll E is free to run on the bushing D. Parts A, C, D, and E are made from tool steel, hardened and tempered. The thread and curling surfaces are smoothly polished. The flange at A, Fig. 6, is slightly formed to aid in the curling operation. The forming can be done in either the stamping or clipping operations which precede the thread rolling. The forming as shown at A, is not necessary if a slight straight in the bead as shown at A, Fig. 8, is not objectionable.

How to Estimate Machine Shop Costs

By Albert A. Dowd

Methods for making preliminary sketches of operation layouts—Good and bad examples of layout sketching—Master sheets and small part drawings for approximate scale layouts

AFTER the preliminary operation sheet has been written the careful detail work is started, and the first step in the process depends largely upon the nature of the work, the organization of the department and the amount of work passing through it. In a large estimating department the preliminary layout

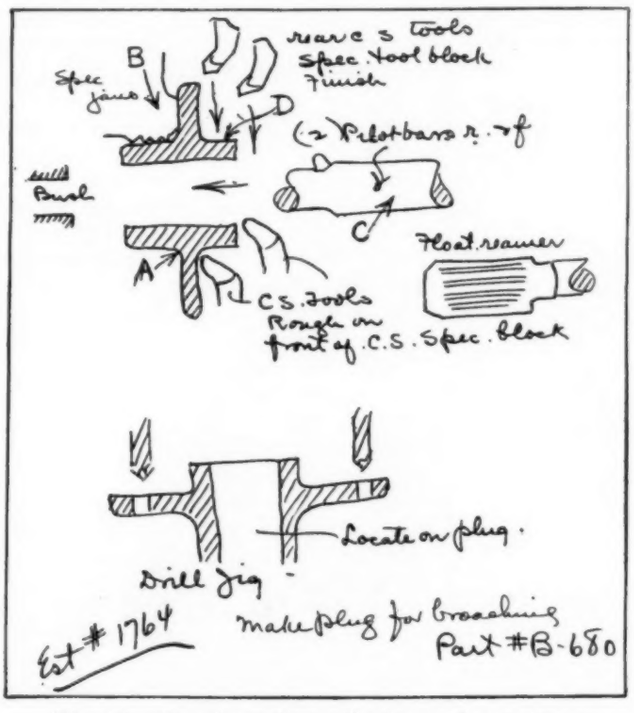


Fig. 12.—Poorly made preliminary sketch for a bearing case estimate

of operations would be turned over to the operation layout men who would make free-hand sketches of various kinds to suggest methods of locating and holding the work for the various operations. The sketches made are often very crude and leave a great deal to the imagination, yet in many cases a crude sketch when made by a thoroughly practical man may answer the purpose very well. The rough sketches are for use by the time-study men and tool men as a guide for their part of the work.

The elementary nature of a poorly made preliminary sketch will be apparent from Fig. 12. A sectional view of the work is shown at *A* and the method of holding the piece is indicated by the outline of the jaws at *B*. The work is bored by two boring bars *C*, a notation being made regarding the front and rear cross-slide facing tools and the reamer used for finishing the hole. The hub *D* is to be turned but this has evidently been forgotten in making the sketch, so the tool men will be expected to provide some means for machining it.

In the drilling of the six holes in the flange the engineer has simply shown a section of the work and specified that it should be located on a plug in a drill jig. He makes no mention of the use of a multiple drill-head, nor does he give any hint as to the type of jig wanted. With a sketch of this kind a verbal explanation would be necessary before the tool man

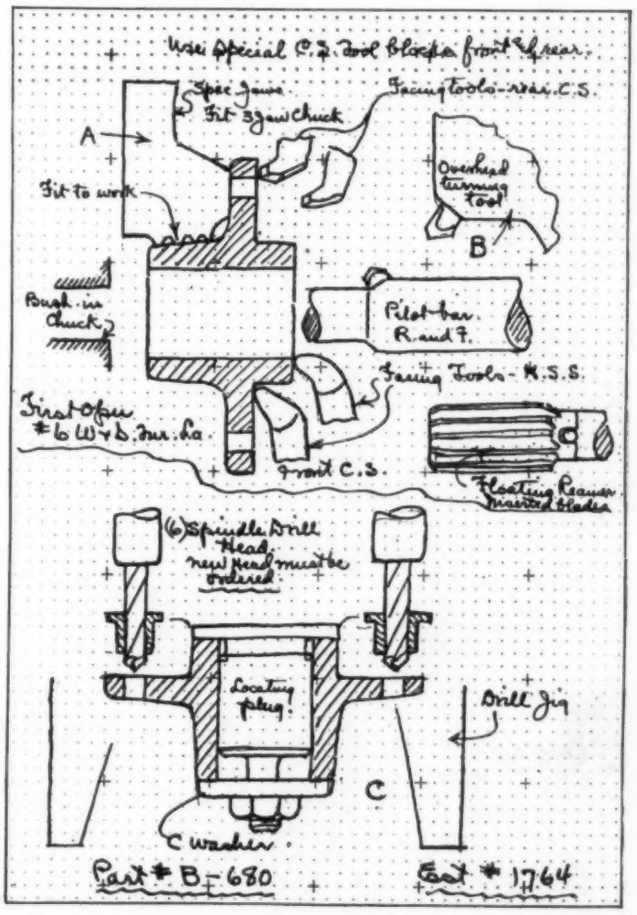


Fig. 13.—Rough preliminary sketch showing method of handling bearing cases

This is the fifth article. The fourth article was concluded on page 775, Vol. 60, No. 21.

could lay out the tools with sufficient clearness for the time-study and estimate men to work to advantage. Verbal instructions are generally unsatisfactory, they are also likely to cause misunderstandings and, although a simple proposition like the one shown could be handled without difficulty, a more complicated one would require a much better sketch in order to make the matter clear.

A much better example of a rough preliminary sketch for the same piece of work is shown in Fig. 13. In this case much more care has been taken with the sketch itself and also with the details of the method to be used. The shape of the chuck jaws at *A* is clearly shown and an overhead turning tool *B* is indicated for turning the hub. The front and rear cross slide tools are shown in their relative positions and a floating reamer with inserted blades is roughly sketched. In fact, all necessary information is given for this operation. For the drilling of the six holes in the flange, a rough idea of the process is shown at *C* and a notation is made regarding the use of a six-spindle drill-head. The method of locating the work on the hub in the jig is clearly indicated, so that the tool men will have no difficulty in sketching a rough jig for estimating purposes. The plug and broach required for broaching the keyway are not indicated in any way, the assumption being that the tool man will obtain the necessary information regarding this from the operation sheet. A preliminary sketch like this is much better than crude markings intended to serve as a guide to the tool man, as indicated in the preceding example.

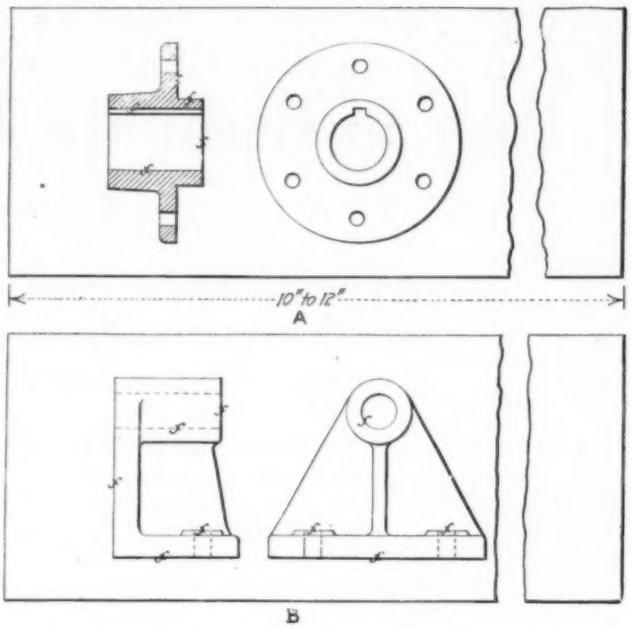


Fig. 15.—Small scale part drawings for use in making preliminary layouts

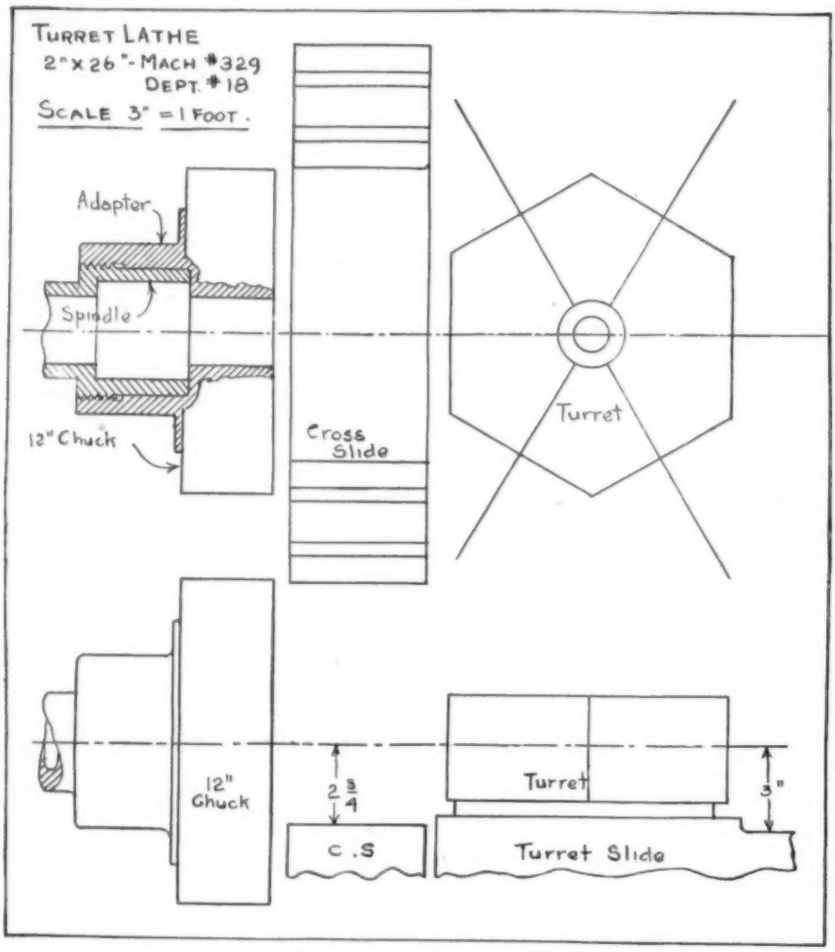


Fig. 14.—Master sheet for turret lathe work

If sketches are made in correct proportion on section-ruled paper, very creditable work can be done free-hand, and the probability of interferences that might be caused by errors in shapes and sizes is much less.

The two sketches given illustrate methods in common use, but there is still another which is in the writer's opinion superior to either of those shown and, although it necessitates considerably more trouble and expense, the results obtained are a decided improvement over any other method in use. A certain amount of preparatory work is necessary, but after this has once been done the layouts can be made very rapidly. If the tool designing department is closely connected with the estimating department, as it usually is, data can be obtained from the former and the work materially lessened.

Master sheets, like the one shown in Fig. 14, can be prepared for the various machines, the drawings being made on tracing cloth and inked so that they will permit considerable handling. The scale is optional, but ¼-size will generally be found convenient. For turret lathe work two views of the chuck, spindle, cross-slide and turret should be made in a similar manner to those indicated in the illustration. The drawings should be made so that enough detail will be given to show clearly just where and how tools and fixtures can be applied

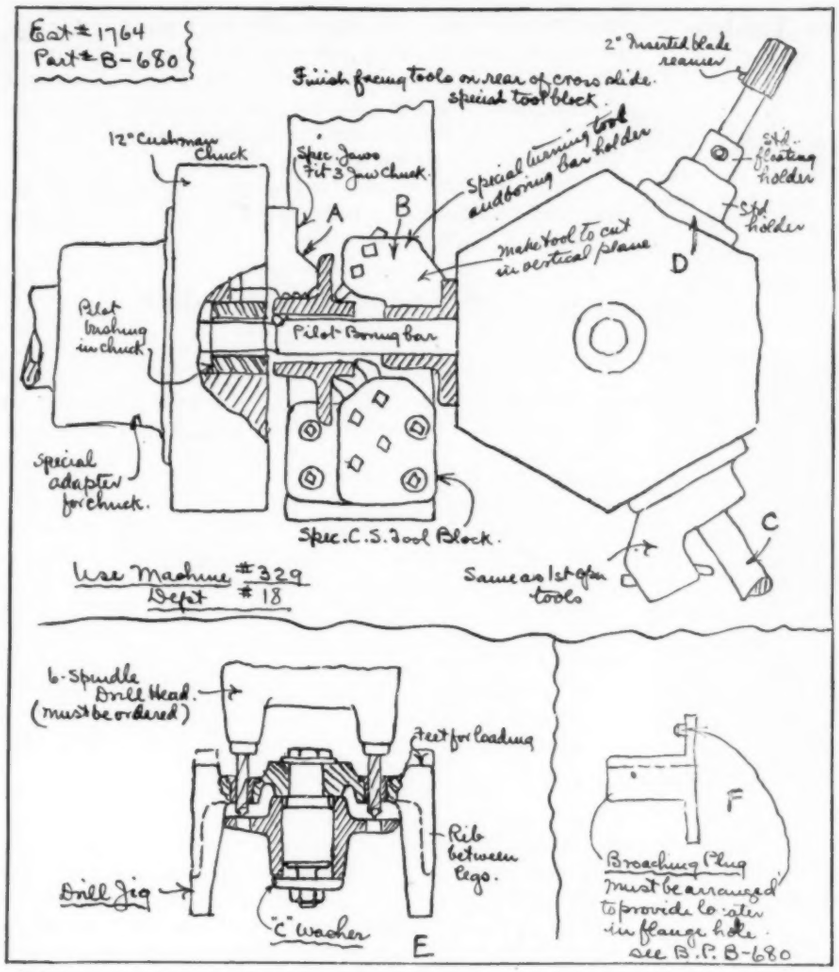


Fig. 16—Free-hand tool layout made by use of master sheet and small part drawing

to the various members. Practically all of the information needed for these master sheets is contained in the machine data sheets, but these should not be used except as a reference. Having prepared the master sheets, we can show the application to a layout of the same piece that has been shown in Figs. 12 and 13, so that the difference between the methods will be apparent.

At *A* and *B* in Fig. 15 are shown two small-scale drawings of parts for which estimates are to be prepared. These small drawings are made to the same scale as the master sheets, with which they are to be used, and it is advisable to make them on strong bond paper using a pencil of a grade soft enough to give a clear and strong line. It will be found most convenient to use paper 10 or 12 in. long, or even more if the work is large, and to make the drawings at one end of the paper strip, so that the other end can be used to manipulate the drawing and bring it into any position desired. These little drawings should be made with two or more views, depending upon the nature of the work and the requirements in tooling.

In making the free-hand layout the master sheet is pinned to a small drawing board, a sheet of tracing paper being laid over it and fastened at the two upper corners. The small scale drawing *A*, Fig. 15, is then slipped under the tracing paper until it is in the correct position in relation to the chuck, and it is then held or pinned in place while the outline is rapidly traced. It is then removed for the time being, while the tool man sketches in the jaws which hold the work, as shown at *A* in Fig. 16.

The work is now located in the proper place, so that the cross-slide tools can be sketched in approximately to scale and with due regard for possible interferences with the turret tools. The boring bar that is to work in conjunction with the cross-slide tools is shown in its proper place, and the overhead turning tool *B* is outlined as shown. The finish boring bar and turning tool are shown at *C* and the floating reamer at *D*. Various notes are written here and there where necessary, the machine number is noted, and the department where it is used. Thus a thoroughly practical free-hand turret lathe operation layout can be made in a very few minutes with sufficient data for the time-study and tool men. On the same sheet at *E* the small drawing is again used while sketching the part, and a jig is sketched around it to approximate scale. Suitable notes make clear the intention with regard to the method of holding and locating. The use of a six-spindle drill head, which must be ordered if the contract is received, is also suggested in the sketch.

At *F* a very simple sketch is made as a suggestion for the broaching operation, and a note regarding the locater is made. A fairly comprehensive layout like this one can be made in a comparatively few minutes, and the information given is complete enough for both tool and time-study men. In one factory this system is employed at present, in even more complete form. The layouts are actually drawn to scale, as well as the jigs, and every tool or gage that is to be furnished is designed in miniature, so that the prospective customer can see exactly how the work is to be handled and what he may expect to get for his money. It is perhaps too great an expense to be carried by the estimating department, but the value to a customer and the impression produced by such a careful piece of work, undoubtedly has considerable weight in influencing the placing of a manufacturing contract.

Guarding Against Over-Lubrication

To attempt to establish any hard and fast rule in regard to the theoretically proper amounts of oil that should be supplied to an air compressor cylinder is never advisable, says an article in *Lubrication*, a magazine published by the Texas Co. Too many variables, such as the size of the compressor, its speed, and the condition of the piston and piston walls are involved. Essentially we must guard against over-lubrication, inasmuch as more trouble will be caused by the use of too much rather than too little oil.

Treat the Drill Press to a New Table—Discussion

By A. W. Forbes

Most of us have seen the drill-press tables referred to by Donald A. Hampson in an article under the title given above on page 424, Vol. 60, of the *American Machinist*, with their surfaces very much cut up by the injudicious use of drills, but I do not see why it is necessary to go to so much trouble to make a new one. If the drill press is of standard and comparatively recent make it surely would be cheaper to purchase a new table, already finished, from the manufacturer.

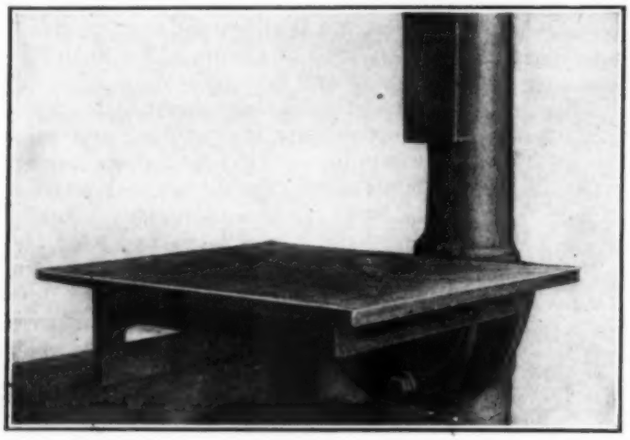


Fig. 1—A new surface for the drill-press table

Another, and easier, way to give the drill-press table a new surface is to bolt a ½-in. steel plate to it, as shown in Fig. 1, the heads of the attaching screws being counterbored into the plate and filed flush. As this particular drill-press is not used for precision drilling, the original surface of the steel plate was considered good enough for the job, but for a precision machine it would be a simple matter to smooth both sides of the plate on a surface grinder.

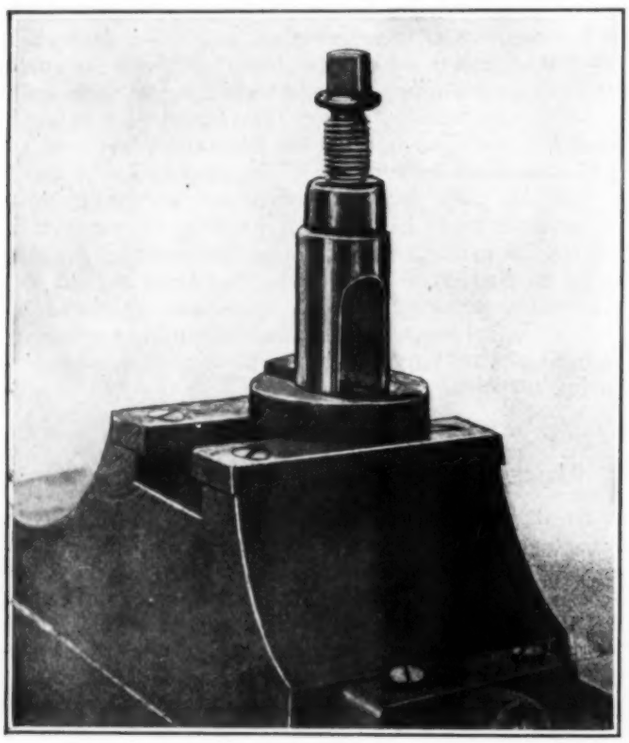


Fig. 2—Repaired toolblock of lathe

A similar plan, shown in Fig. 2, is adaptable to the damaged toolblock of a lathe carriage, and is applicable wherever a T-slot is required.

Keys for Sliding Gears

By Entropy

We have been having some trouble with a machine in which a small amount of power is transmitted through a shaft on which slides a gear driven by means of a feather. The factors of interest in the case are as follows:

Diameter of shaft 2 in.
Feather key, ⅜x⅜x2 in.
Radius of driving pulley on shaft 15 in.
Approximate pull on belt 30 lb.

Since the radius of the pulley is fifteen times that of the shaft the pressure on the key must be $15 \times 30 = 450$ lb. The area of the side of the key against the spline in the shaft is $\frac{3}{8} \times 2 = \frac{3}{4}$ sq.in.

$$\text{Pressure per square inch} = \frac{450}{\frac{3}{4}} = 1{,}200 \text{ lb.}$$

This is the unit pressure under which this key must slide lengthwise on the shaft. To be sure, it slides very slowly, but the material of both key and shaft is rather soft steel, and the lubrication is accidental, to put the best construction on it. We do not find any tables to justify us in any other assumption than that the thing will abrade and finally stick. The only thing that has saved it so far is the fact that we have had little work requiring the full power that the belt can easily carry.

This case points to conditions which are quite prevalent in general machine tool design, namely, too small feather keys; too great a pressure between the sliding key and the side of the spline in the shaft; and no provision for anything but casual lubrication. It is doubtful if any such key ought to be designed to carry over 400 lb. pressure per sq.in. In this case, if the key had been twice as long and half again as deep it would probably have given us no trouble. If the necessary dimensions must be cut, it may help the matter if the key is casehardened.

This may seem like a small detail and most designers never figure these possible pressures at all, making the key about as they have seen it elsewhere. The power loss is very little because of the very small and slow motion of the sliding parts, but the possibility of damage to the key or shaft, whenever a full load is thrown on, is too great to justify designing by guess.

The foreman who is to be really successful, who is to grow out of his job into one of larger opportunities, must be above petty jealousies of any kind. He should encourage suggestions from his men, as this is one of the many ways of increasing production.

The foreman who frowns on such suggestions, who fears that the management may think he should be capable of making all improvements himself, will never get very far up the ladder. For if the management is of that type, he has little change of advancement.

Albuquerque Shops of the Santa Fé

By Howard Campbell
Western Editor, *American Machinist*

New shops of A. T. & S. F. R.R. at Albuquerque practically completed — Latest type of buildings and equipment — Machinery grouped according to sequence-of-work plan—Details of operation

THE new shops of the Santa Fé Railroad, which have been built at Albuquerque, N. M., to handle locomotive repairs for the western lines, the north and south districts and a large proportion of the coast lines, are the largest shops that have been built in recent years, employing approximately 2,000 men when running at full capacity, 1,300 of which will be used in the locomotive department. This force will be able to turn out 40 engines per month. The buildings are of the latest type of construction, with walls that contain as much glass as possible so as to obtain a maximum amount of light. All buildings are fireproof, being built of reinforced concrete and steel. The floors are of wood block and the lighting system, which is overhead, is sufficiently adequate so that no lights are required on the machines. Heat is supplied in cold weather by a system of blowers that pass the air over steam-heated coils and distribute it throughout the shop. The same system is used for cooling the shops in summer, the coils being chilled so that the air will be kept cool.

The main building is 604 x 280 ft., and houses the machine shop and erecting floor. The erecting floor consists of 26 stalls, arranged latitudinally in one of the side bays, 24 of the stalls being used for erecting work and the other two for stripping. The erecting floor equipment includes two 15-ton cranes and one 250-ton crane, shown in the illustration Fig. 1, which is capable of lifting the largest engine used on the system. Each pit is equipped with air-lines and gas-welding units, and electric connections are placed at convenient intervals along the wall for use in supplying current for portable welding machines, portable lathes and other electric-driven devices. The center bay is occupied by the heavier machines, such as the tire boring mill, press, journal lathe, wheel lathe, quartering machine, and similar machines. All machines in this bay are motor-driven and most of them are equipped with 1½-ton air-hoists. Two 15-ton traveling cranes are also available in this bay for handling material and to facilitate the handling of work in and out of the larger machines. The lighter machines are placed in the other side bay, where they are arranged by departments on the sequence-of-work plan, a particularly good arrangement which is accredited to Jack Leverage, assistant superintendent of shops. Each machine is equipped with an air-hoist to facilitate the handling of work, and a monorail is provided which operates the full length of the bay. A balcony which extends the entire length of this side of the shop is occupied by the air-room, tool-room, locker and wash room, and the electric department. Three freight elevators convey material to and from the main floor to the balcony.

All work is finished on an engine while it is in the stall unless it requires heavy boiler work, in which case it is moved to the boiler shop, which is a separate building opposite the erecting department and of the same length. A transfer table is placed between the two buildings for use in moving engines in and out of the erecting floor stalls, between the erecting department and the boiler shop and to transfer finished engines to the inspection shed and the outgoing track. A renovating plant has been installed which is equipped with the latest type of machinery for reclaiming old waste and oil. All packing waste taken from locomotives and tanks and cars is put through a process of boiling, separating and cleaning. The waste is first put into vats and heated by steam to the boiling point, then it is removed from the

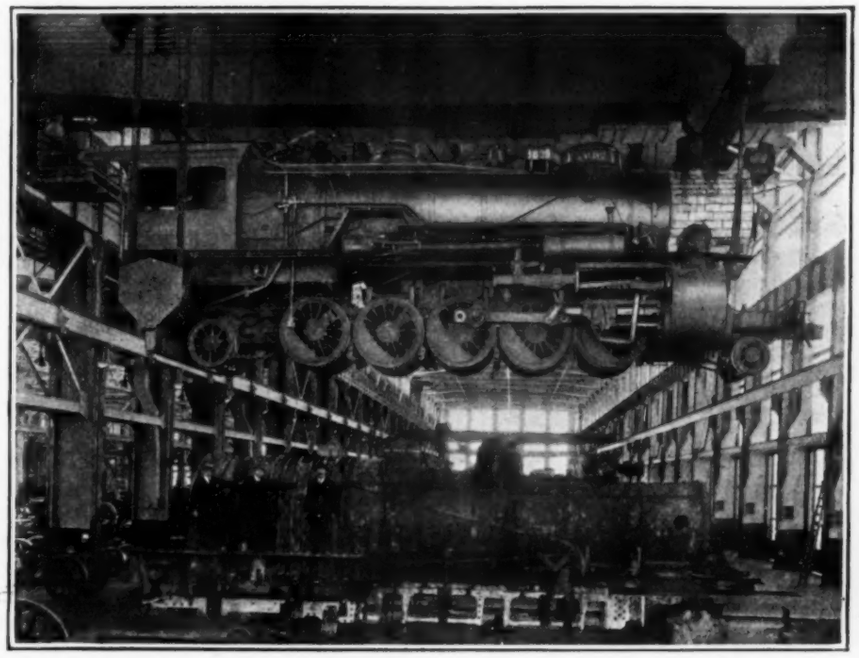


Fig. 1—250-ton crane in erecting bay

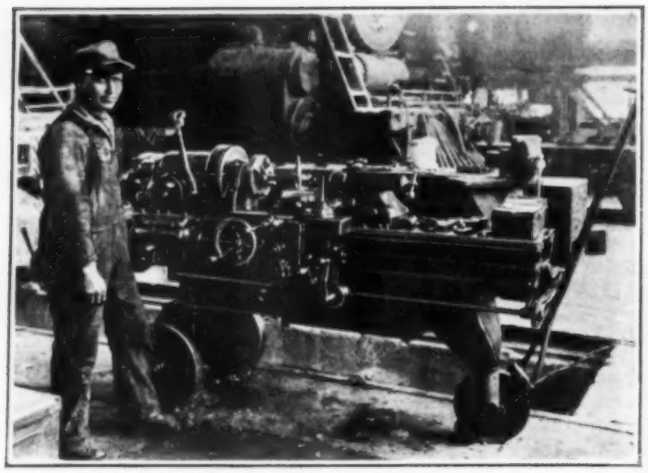


Fig. 2—Portable engine lathe

vats and placed in a separator which separates the oil from the waste. The oil is then filtered and the waste is sent to the cleaning table after which it is put up in 100-lb. bales. All oil and waste reclaimed is returned to the department from which it was received and is again

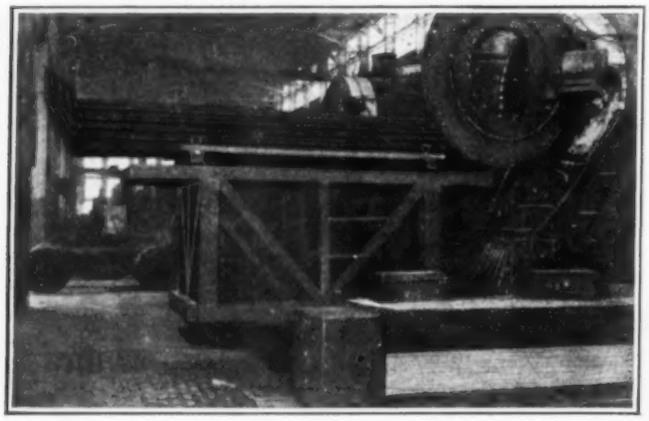


Fig. 3—High trucks for super-heater units

used for packing. An average of 20 gallons of oil is extracted from every barrel of waste.

The blacksmith shop, which is located north of the machine shop, is undergoing many changes. Three new steam-hammers are being installed, one 4,000-lb. hammer and furnace, a 2,000-lb. hammer and an 1,100-lb, hammer. Three oil-burner furnaces are in use at the present time and more are to be installed in the near future. Two new blowers have been recently installed for supplying air to the forges. Plans are also under way for a complete tool forging and hardening outfit. All frame work is done in the blacksmith shop and all forgings used on the locomotives are made here, scrap staybolts being used for making the forgings. The

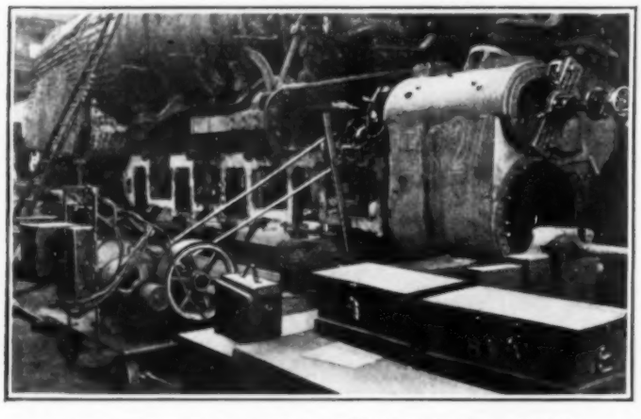


Fig. 4—Portable electric cylinder-boring machine

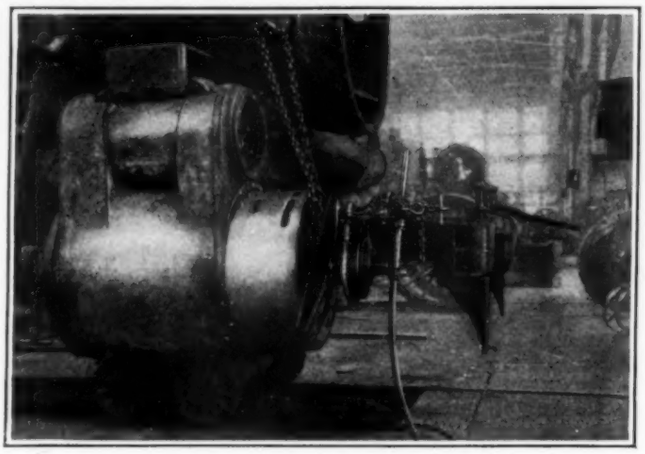


Fig. 5—Pressing a bushing into a cylinder

staybolts are heated and forged into 6 x 10 x 60 in. billets, which are later forged into drawbars, binders and other parts in which this kind of material can be used. All bolts used on the locomotives are made in special dies. Discarded axles are used for making piston rods, cross-heads and knuckle-pin forgings. Old driving tires are re-forged into cross-head keys, valve stem keys

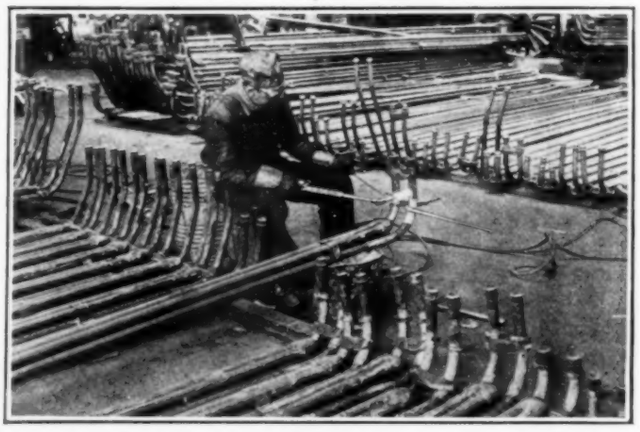


Fig. 6—Spot-welding reinforcements on to super-heater units

and front end rod key forgings. The blacksmith shop has 19 forges, 8 hammers and 4 furnaces which are used for heavy work.

The welding department is located in a separate building between the machine shop and the roundhouse, and is equipped to do both electric and gas-welding. Pre-heating furnaces are also installed for pre-heating cast iron and other parts. There are ten units for gas-welding and a four-panel machine for electric welding, the outfit requiring fourteen welders. Gas-welding connections are also installed throughout the machine

Fig. 7—Forming super-heater unit reinforcements

shop, boiler shop, yards, blacksmith shop and car department. The locomotive department has 121 gas-weld units and the car department, 40 units. The oxygen and acetylene are piped from a central plant that is located north of the boiler shop, where the acetylene is generated. Oxygen is bought in drums that are connected to a thirty-station manifold which distributes the gas through feed pipes to the various departments.

A large part of the equipment througnout the plant is quite new and all equipment is kept in first-class running condition. An engineer is detailed to look after the efficiency of tools and methods, and tools and fixtures to expedite the work, are being made up as fast as possible. The erecting floor has not been overlooked in this respect, and special equipment has been installed wherever it can be used to advantage. The portable engine lathe shown in the illustration Fig. 2 is used exclusively for the production of bolts for use on the erecting floor, the operator moving it about from one section of the floor to another as required. The assembling of superheater units to locomotives is facilitated by the use of high trucks similar to that shown in Fig. 3. The trucks are well constructed, of heavy timbers, and are set on to car wheels so that a truck can be run in on the same track as the locomotive that it is to serve.

A portable electric cylinder-boring device is shown in operation in Fig. 4. The operation of the machine itself does not differ from that of the ordinary portable boring device. The boring bar is driven by an electric motor through a belt and train of gears as shown.

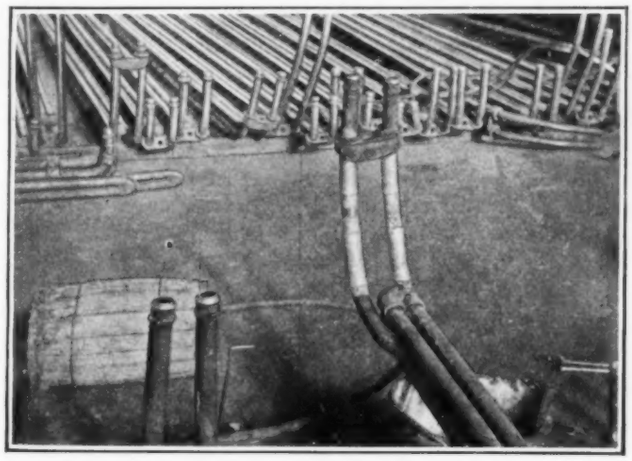


Fig. 8—Unit showing reinforcements

Another excellent labor-saving device is the apparatus shown in Fig. 5, with which the bushings are pressed into the locomotive cylinders. A 2½-in., 4 P. screw is inserted through the cylinder and anchored at the rear end. On the front end is a brace which engages the end of the bushing, and an arrangement that consists of an air-motor and a train of gears, the axis of the driven gear containing a brass nut which is threaded on to the screw. When the air is applied, the nut turns and feeds itself along, forcing the bushing into the cylinder as it travels along. The nut makes approximately 7½ turns per min., and the job is done in one-quarter of the time that would be required if it were done by hand.

An "ounce of prevention" is exemplified by the job shown in the illustration Fig. 6. The operator shown here is spot-welding reinforcements into the curves in super-heater units, using a gas-welding torch to do the job with. The spots indicated become worn by cinders in a short time, and this method of attaching reinforcements was devised for repairing them. The reinforcements are made of ⅛-in. steel, formed with the aid of the tool shown in Fig. 7. This is an air-cylinder, attached to a bench as shown and connected to the air-line. The lower half of the die is placed in position and the upper half is attached to the lower end of the piston. A flat piece of stock, indicated at *A*, is placed in the die and when the valve is opened the piece is pressed to the desired shape. A unit to which the reinforcements have been welded is shown in Fig. 8.

(To be concluded)

Convenient Eye-Shield for Grinding Stands

BY FRANK MCGOUGH, JR.

The illustrations show a very simple and convenient form of glass eye-shield, used on grinding stands in the Santa Fé shops at Albuquerque, N. M. In the illustrations, Fig. 1, shows the glass down in the safety

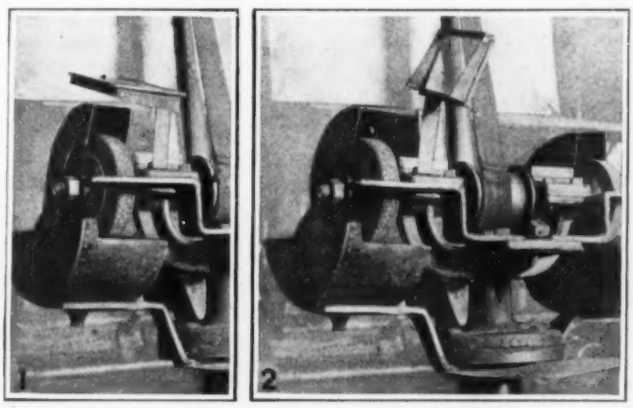


Fig. 1—Eye-shield in safety position. Fig. 2—Shield turned up out of the way

position, while in Fig. 2 it is swung up out of the way for handling work where it would be in the way if lowered over the wheel. In either case the operator is supposed to wear goggles, to protect his eyes.

The support is made of ⅛-in. steel, or lighter, and is so arranged that the glass can be readily replaced in case of breakage from any cause.

The Genesis of a Dual Personality

Being a Further Discussion Upon the Subject of "Come-iners" versus "Come-outers"

BY HARRY SENIOR

I AM DEEPLY gratified to note that my feeble attempt at satire published upon page 458, Vol. 60, of the *American Machinist*, in which I sought to arraign a certain small percentage of industrial managers under the indictment of being "come-outers," has struck fire; and that the sparks have been caused to fly in such an agreeable and acceptable manner by D. Wright, who seeks, under the above title, page 649, to defend the maligned individuals upon such ample and comprehensive grounds.

In expressing my admiration for the able manner in which Mr. Wright has handled the defense, and acknowledging the strong provocation under which the average industrial manager is tempted or driven into the "come-outer" class (I have been a shop manager myself) I nevertheless feel impelled to question the exact justice of visiting the managerial displeasure caused by undesirable callers upon the caller who is still a stranger. It savors too much of the principle of assuming the guilt of the prisoner-at-bar until he has been proved innocent; a proceeding quite contrary to our American ideals.

A caller who has shown himself to be ignorant of, or inclined to disregard, the nicer conventions of business intercourse is not entitled to complain because he gets no better treatment than he deserves. For a manager to tell such a person that he is trespassing, or even to request him to leave, is not discourtesy—it is necessity. It were better that a manager should decline to see a caller, either inside of his office or out, who has already displayed his lack of consideration for the rights of other people, for then the employers of such a "misrepresentative" will be compelled to shunt him into some form of employment for which he is better fitted and thus lessen the burden of vicarious punishment that must inevitably fall upon the shoulders of deserving men.

My brief, as expressed in my article above referred to, is in behalf of the caller who has yet to make the acquaintance of the man upon whom he is calling. He is a stranger in a strange land. His opinion of the business, the methods, the personnel, is going to be tinctured very largely by the impressions that come to him during the period of minutes, or it may be hours, that elapses after he has entered the door and before he has gotten down to brass tacks with the manager, and it is very likely that his opinions are going to be the opinions of a possibly large and influential business contemporary.

It is not for me to question the justice or the propriety of opinions founded upon first impressions. Right or wrong, they will be so founded. I am citing, not ethics, but facts. If the opinion is a wrong one and the man is of the right sort, the opinion will eventually be corrected, but the correcting process may be a long, tedious and possibly an expensive one. Is *any* business manager big enough to take the risk?

In his letter Mr. Wright wants "to kill off—right off the bat—any notion existing in the mind of a disgruntled caller as to the hidebound unprogressiveness of the executive upon whom he has called that is based entierly upon the kind of reception that he has been accorded."

Notions, like noxious weeds, may be killed off, but the killing of either is more easily desired than accomplished. Would it not be better to go a short distance out of our way to forestall their inception than to go a longer way at a later time to destroy their malignant growth? Notwithstanding the entire inadequacy of the ground for such a notion as above cited, the fact is still proverbial that the busiest executives are invariably the most accessible.

Mr. Wright admits that the class of callers to whom he is a "come-iner" is constantly growing. May we not hope that it will continue to grow, to the entire extinguishment of the class to whom he is still a "come-outer," and that when that happy consummation shall have been reached he will look back upon that time when he was wont to direct a supercilious office boy or gum-chewing flapper clerk to "tell Mr. Smith I will be out in a minute," as a sort of probationary period through which an industrial manager must pass before he can hope to compel the admiration and respect of even those disgruntled callers who still continue to hate him because of his success.

Famous Machinists of History

BY H. H. MANCHESTER

Benjamin Huntsman (1704-1776)

BENJAMIN HUNTSMAN was born in Lincolnshire, England, in 1704, his father being a Quaker of German descent.

Little is preserved of Benjamin's early life, but it is known that he became a skillful machinist. While still a young man he started in business for himself in Doncaster, as a maker of locks, jacks, and clocks. He made his own tools with which he produced them, and originated several improvements in the tools.

He bought his steel ready-made, but found himself continually hampered by the inferior quality of the ordinary steel supply. This led him to start experimenting on the production of better steel by casting. His method was to melt the raw steel with fluxes in inclosed earthen crucibles. It was several years before the method was perfected, and, while still experimenting, he moved in 1740 to Handsworth, near Sheffield, which was more of a steel center.

Even after he had learned how to produce a high grade product, the Sheffield cutlers would not use it, as it required too great effort, and at first all of it was sent to France. This so improved the quality of French cutlery that the Sheffield cutlers tried to have a law passed against the exportation of English steel, but were finally compelled to use Huntsman's product.

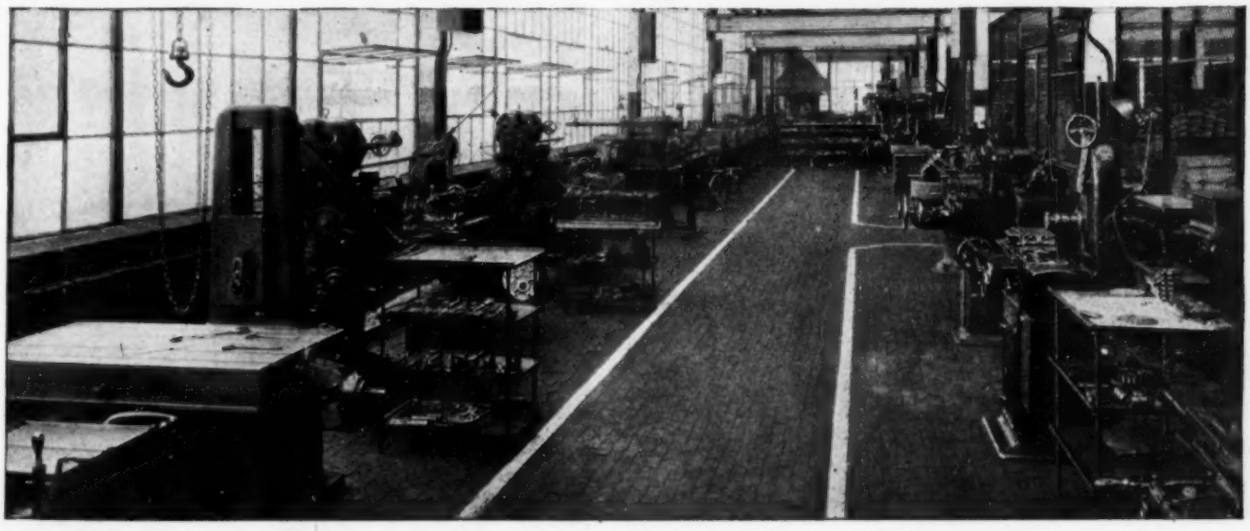
In 1770 Huntsman moved to a larger plant north of Sheffield. He had taken out no patent, preferring to keep his process secret, and doing the most essential part of it at night. The method, however, was finally learned by one Walker, who hung around the plant in the guise of a tramp.

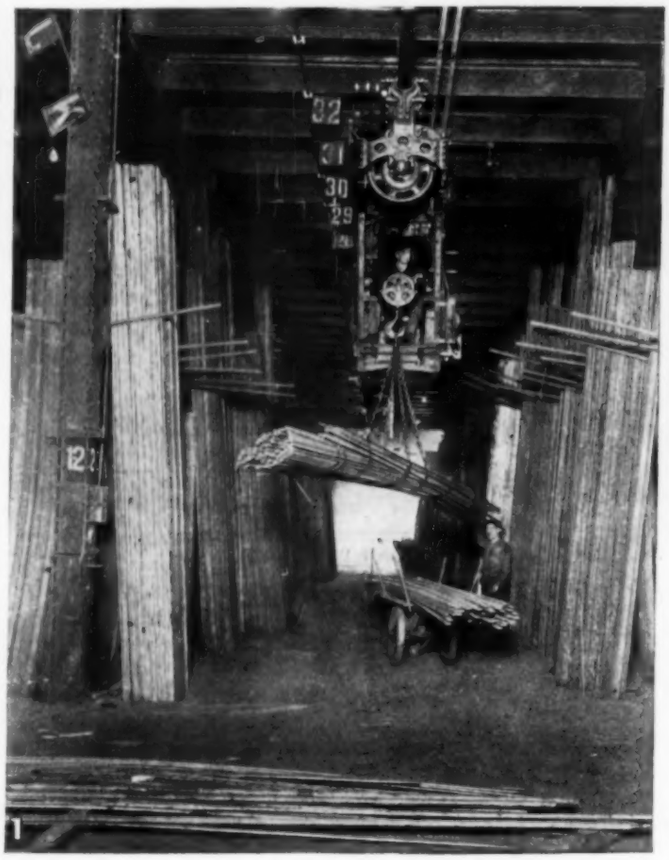
Hartsman's business continued to enlarge until his death in 1776.

Where Machine Tools Are Made

Consolidated Machine Tool Corporation of America
Colburn Machine Tool Works

Founded 1901





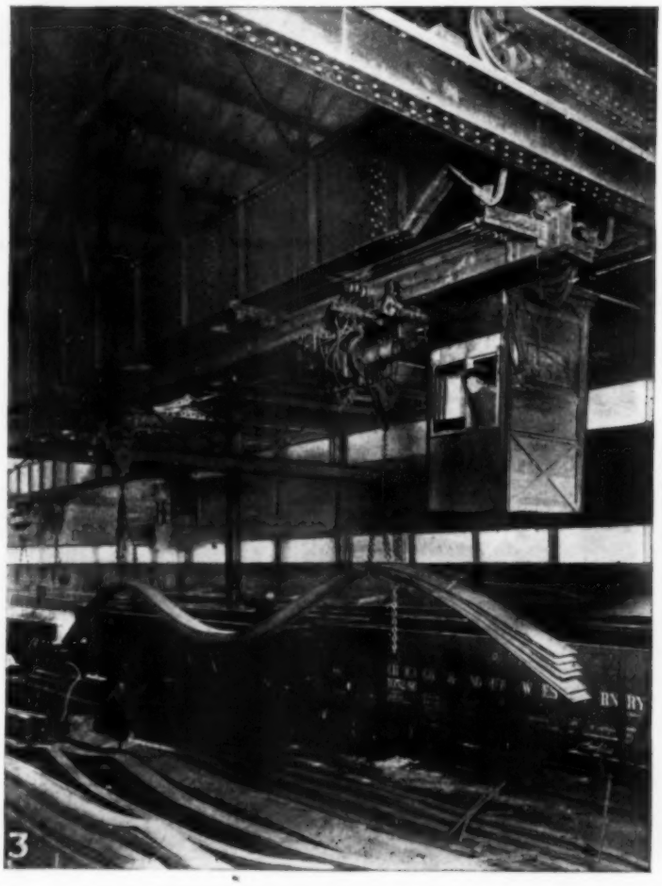
Handling Steel in a L

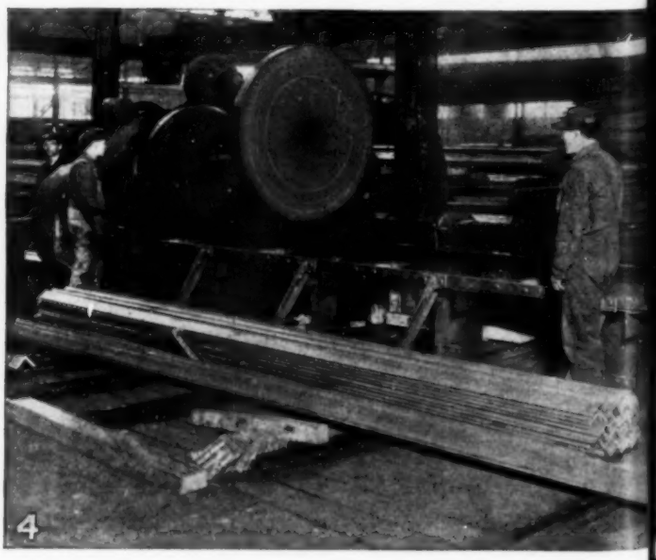
Fig. 1—An aisle in the bar storage

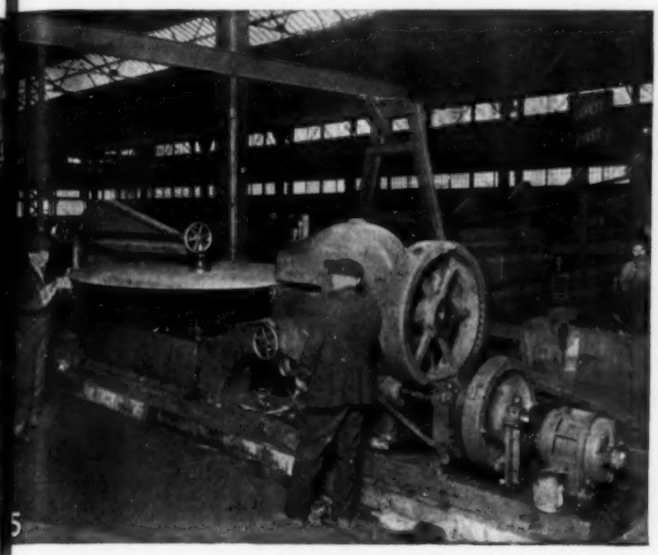
Fig. 2—Storing structural steel

Fig. 3—Loading long plates in gondola cars

Fig. 4—Cutting angles to length







a Large Service Plant

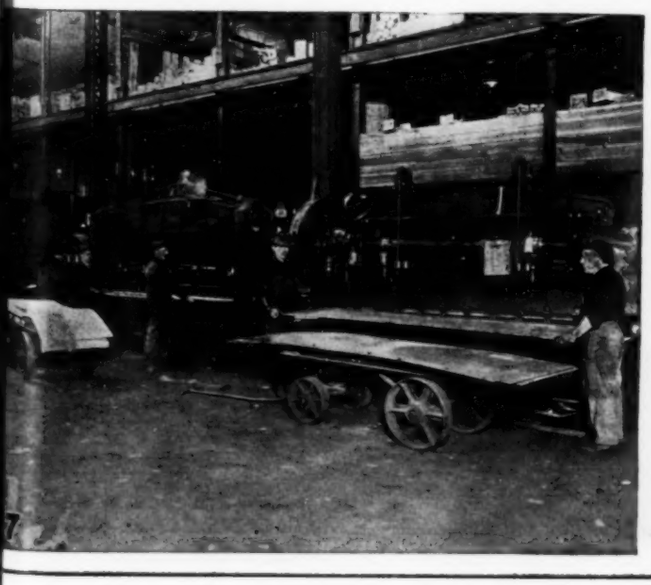
Fig. 5—Shearing circular plates

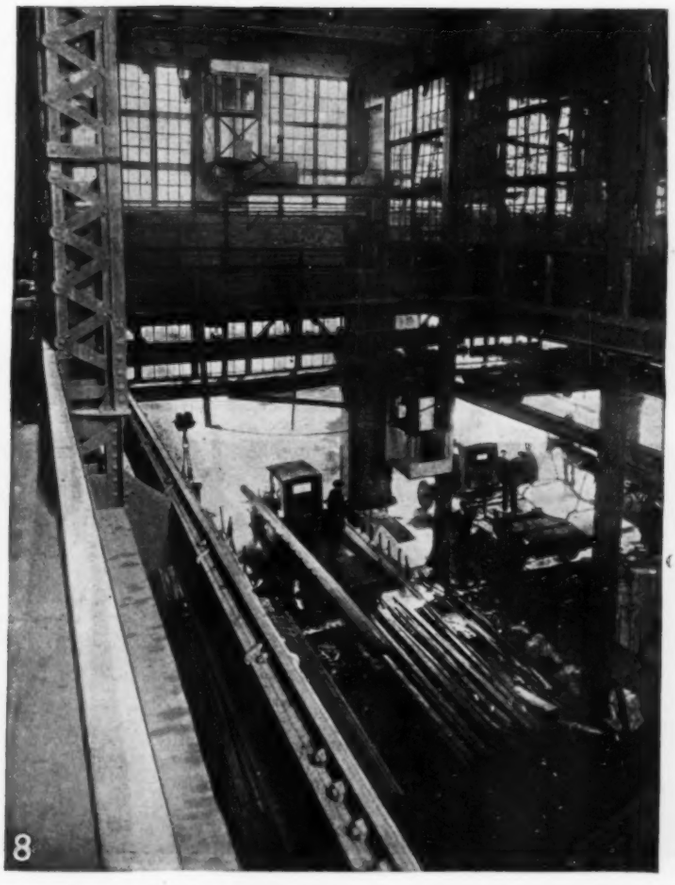
Fig. 6—Tool-steel department

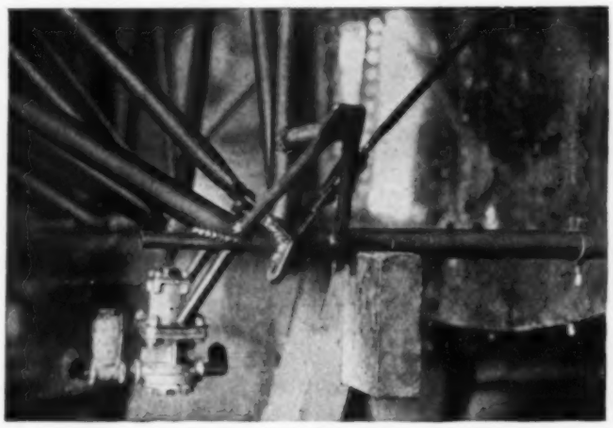
Fig. 7—Battery of shears for cutting sheets

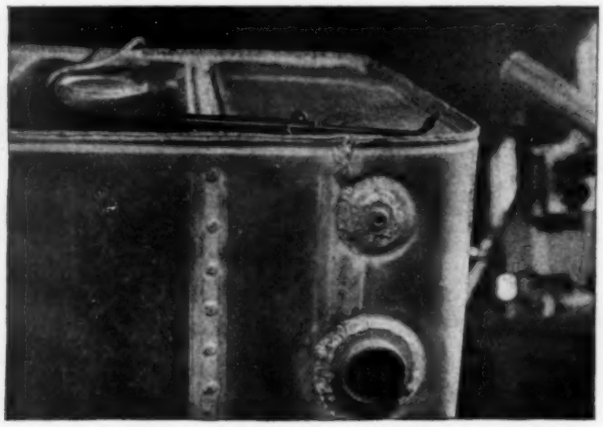
Fig. 8—One of the shipping bays

Photographs by courtesy
Joseph T. Ryerson & Son, Inc.









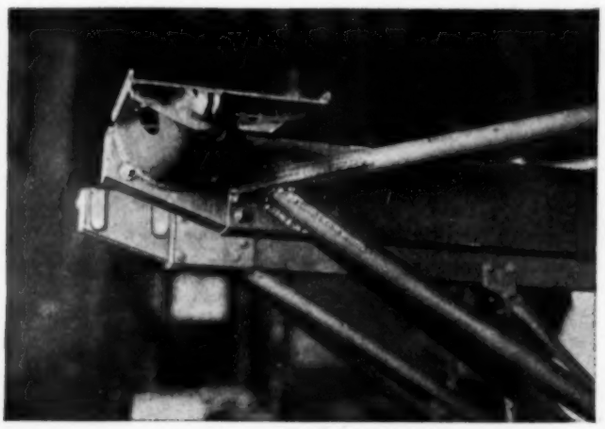
Welding's Part in the World Flight

Four Douglas planes started from Santa Monica, Calif., on March nineteenth to fly around the world. Built under government supervision they are so designed that the landing gear can be replaced by floats. As land machines they have a cruising radius of 1,800 miles—as seaplanes they are good for 1,450 miles.

Our photographs show one of the ships and some close-ups of a welded tank and the forward end of the welded tubular fuselage.

The men comprising the crews have parachutes strapped to them, and to each man is allotted forty pounds of baggage, a 0.45 caliber automatic pistol, fishing tackle, and emergency rations for forty-eight hours.

Photographs by courtesy the Purox Company



Economic Analysis of Machine Shop Operations

By A. L. De Leeuw

Machining methods alone considered — Unit cost of a single operation — Comparison of various methods of performing a single operation from an economy standpoint

THE best machine-shop methods are those which give the highest ultimate economy under the existing conditions. This statement of an obvious truth is made here at the beginning of the paper in order to call particular attention to the fact that it is the ultimate economy which counts and not the economy of a single operation, and that some method or methods may be good under one set of conditions and bad, or at least less desirable, under another.

To exemplify: What may be the most economical way of turning a piece when it must be ground is not necessarily the best method when the piece is to be finish-turned. Again, what is the best method of machining when a steady stream of work goes through the factory may not be the best method when the work is seasonal.

Many factors must be taken into consideration when the method of machining of a piece of work is to be decided on, even if the economy of a single operation only is being investigated. When the ultimate economy must be analyzed the problem becomes even more involved.

This paper deals with the problem of analyzing machine-shop operations with an eye on the ultimate economy. However, no factors will be considered which do not bear directly on the machining operations. Such items as handling facilities, routing systems, systems of wage payment, etc., will be ignored. They contribute to the ultimate economy of the shop but not to that of the machining methods.

Determining Unit Cost of a Single Operation

In order to approach the subject gradually, consideration will be given first to the simplest possible problem, namely, one operation only on only one kind of piece. It will be seen that even under these extremely simple conditions there are still several items that determine which method should be followed.

Let n = number of pieces produced per hour

w = wages per hour

N = number of hours per year during which this operation is performed

V = cost of machine, floor space, and permanent equipment

p = percentage charged for interest and depreciation

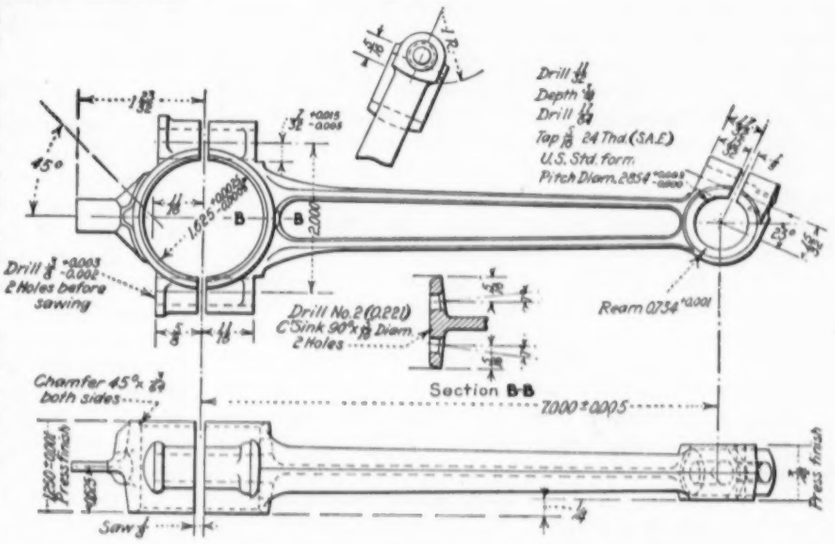


Fig. 1—Drop-forged automobile connecting rod

f = factor (action) denoting that part of the time the machine is usefully employed.

Then fnN is the number of pieces produced per year at a direct labor cost of wN, and pV is the overhead directly chargeable to the machine. The unit cost is then

$$\frac{pV + wN}{fnN}$$

This formula does not take all possible factors into consideration but lends itself well for a first approximation. It shows at once that unit cost is inversely proportional to n (the number of pieces per hour) and to f (the factor of employment of the machine). It shows also that there is no proportional relation with the other factors, namely p, V, w, and N.

As unit cost is proportionally connected to f and n, these factors may be omitted in further analysis. They must be considered in computing actual cost.

Presented at the Spring Meeting, Cleveland, Ohio, May 26 to 29, 1924, of the American Society of Mechanical Engineers.

The formula now becomes: Unit cost is proportional to

$$\frac{pV}{N} + w$$

in which the first term is the machine cost and the second the wage cost. It should be noted here that the machine cost is figured for the number of hours the machine is operating and not for the number of hours it is standing in the shop. This is important when special machinery is introduced.

As an example the following figures are chosen:

$V = \$8{,}000$ $N = 2{,}400$
$p = 15$ per cent $= 0.15$ $w = \$0.75$

$$\frac{pV}{N} + w = \$1.25$$

This $1.25 is the cost of the operation done when the operator can produce n pieces per hour, and when he and the machine can be kept busy the fraction f of the total time. For instance, if the operator works at the rate of 100 pieces per hour but can keep busy only 80 per cent of the time, the unit cost will be $125/(0.80 \times 100) = 1.5625$ cents.

Additional Factors Entering into the Complete Formula for Unit Cost

Certain factors did not appear in the general formula and may be left out for a first approximation. These factors will now be considered.

Tool Expense. In the first place, there is the tool expense. This consists of two items, first cost and cost of maintenance—sharpening. Where a certain tool is used constantly for one operation only, these two items can be calculated, and should be if the tool or its maintenance is expensive. Where an operation can be performed in various ways and with different tools, the tool cost may well be the deciding element. However, in all cases this item of expense appears as an addition to the value expressed by the formula. The unit cost C_u is then

$$C_u = \frac{pV + wN}{fnN} + t_u$$

in which t_u is the unit tool cost. This unit tool cost is independent of the other factors appearing in the formula.

Cost of Power. Another item which might be considered is the cost of power. However, power is required whatever machine is used to remove the metal and is in almost all cases a small item. The actual power cost may be fairly great, but if so, it is because large amounts of metal must be removed—and this is done by the heavy machines for which the machine cost per hour is necessarily large.

As an illustration a planer may be considered which to remove 20 cu.in. of metal per min. requires about 15 hp. This may be assumed to cost 30 cents per hour or $720 per year of 2,400 hours. A planer capable of doing this work may cost, say, $10,000, so that the machine cost per year would be $1,500. If the nature of the work is such that no other machine but a planer can do it, this power cost will be unavoidable, but if the work is of such a nature that there will be a choice between planer and milling machine, the difference in power cost may have to be considered. In such a case it may be found that the milling machine consumes 22½ hp. costing 45 cents per hour or $1,080 per year. On the other hand, the machine cost will be less, say, 15 per cent of $5,000 = $750.

Furthermore, the full power cost should not be figured in during the entire year. Though there are cases where it may be advisable to analyze cost along these lines, such cases are extremely rare in the actual manufacturing of articles in large numbers. If considered at all, it is to be borne in mind that the power cost is also independent of the factors appearing in the original formula and is merely added to the cost indicated by it.

Set-Up Time. Still another item is the set-up time. This item modifies the factor f. If this factor is 0.8 during the time the machine operates, then the actual factor to be used is less than 0.8 and becomes so by the fact that machine and operator were non-productively employed during the time required for setting-up. It will be seen, then, that f is variable and depends on the length of the job. This matter is of importance when the job is of short duration; it is of small importance for long jobs and vanishes when a machine is constantly employed on the same work.

For the rest, the factor f takes care of a number of items such as tool renewal, temporary absence of the worker, etc. In factories where each machine is assigned to a certain job, the factor f should be determined and should be carried on the record as a constant.

The value of the unit cost as expressed by the formula and its additions can be used to compare the economy of various methods of performing a single operation.

Comparison of the Economy of Various Methods of Performing a Single Operation

The examples of comparative analysis given in this paper all refer to machining operations on the automobile connecting rod shown in Fig. 1. This piece requires various operations of drilling, reaming or broaching, spot facing, chamfering, tapping, milling, and sawing. Later on, combinations of some of these operations will be considered; for the present, however, a comparison will be made of various methods which may be employed for some of these operations singly.

As a first example the simple operation of sawing the slot at the small end of the connecting rod will be taken. Three cases will be considered: namely, (*a*) when the quantity is 100, (*b*) when it is 10,000, and (*c*) when it is unlimited.

In the first case a machine already available must be selected, the quantity being too small to justify consideration of a machine more especially adapted to the work. This is always true for small quantities, or rather for jobs of short duration. In this case almost any milling machine will do. The piece can be held in a vise with the small end resting against a stop clamped to the table. This brings the head in the proper place and at the proper angle. As the plane of the saw is parallel with the direction of table feed, the opening of the vise must be at right angles to this direction. So placed, it is possible to use either the table feed or the vertical feed.

In all milling operations the cutter should be as small in diameter as possible, consistent with the requirements of the work and with proper size of arbor. Assuming the arbor to be 1 in. in diameter or about 1½ in. over the arbor collars, the size of the cutter must be 1½ in. + 2 × depth of cut = 1⅞ in. To allow for the proper amount of penetration when the vertical feed is used, and for the fact that a standard-size cutter is desirable, a 2-in. cutter will be selected. The question remains now which feed to select.

Using the table feed requires a cutter traverse of ¾ in. plus the approach, which in this case is about ½ in. The total length to be milled is therefore 1¼ in. If the vertical feed is used the length to be milled is equal to the depth of the slot plus the offset in a 2-in. circle when the chord is ¾ in. This is less than ⅛ in., so that the distance to be traversed by the cutter is ⅛ in. or, say, ¼ in. We therefore select the vertical feed.

Ignoring tool cost and power cost, the method of calculating is as follows (certain figures being assumed for obvious reasons):

Speed of cut.....	70 ft. per min. (135 r.p.m.)
Feed per revolution....	0.030 in.
Feed per minute.....	4.05 in.
Time for cut.....	10 sec.
Time for chucking.....	15 sec.
Time for returning table.....	5 sec.
	30 sec.
Time for 100 pieces....	50 min.
Time for set-up.....	25 min.
Total time.....	75 min.
Value of machines and floor space.....	$2,000
pV = $300 per year	= $0.125 per hr.
w = wages	= 0.75 per hr.
Total per hr.	= $0.875
Total cost of job....	$1.095
Unit cost.....	1.095 cents

(To be continued)

"Enveloping" Gear Teeth

THE advantages of the geared turbine as applied to marine propulsion are indisputable, but it cannot be denied that there have been some very disheartening failures. Different opinions are held by different engineers as to the causes responsible. Many have been disposed to blame the workmanship, others the general design or the character of the material used, and it will be remembered that at the spring meeting of the Institution of Naval Architects last year, it was stated that C. A. Parsons had come to the conclusion that it was desirable to revert to the use of a softer steel than that which had of recent years come into favor for the pinions. Another proposal has now been brought forward by Bostock and Bramley of Netherton, Huddersfield, who have pointed out that the stress on the material can be greatly reduced by changing the tooth form. We illustrate in Fig. 1 the type of tooth they propose, which, after exhaustive comparative tests, has been definitely adopted by Vickers, Limited, as the Vickers, Bostock and Bramley "enveloping" gear teeth. The special characteristics of the teeth are, firstly, that engagement takes place only during the arc of recess, and, secondly, that the flanks of the wheel teeth are hollow, thus reducing the relative curvature of the two opposing surfaces. As is well known, the intensity of the pressure due to a given load is greater, the greater this relative curvature. When the abutting surfaces are both convex, this relative curvature is the sum of the individual curvatures of the two surfaces, but when one is concave and the other convex, the relative curvature is the difference of the two curvatures. The advantage thus gained will be very evident on comparing Fig. 1 with Fig. 2, the latter representing standard practice with involute teeth. The "enveloping" teeth, it should be added, can be "generated," using the same machine as employed for cutting involute teeth. The tooth form is intermediate between that of cyclodial and involute. In the new tooth, the proportion of slide to roll is

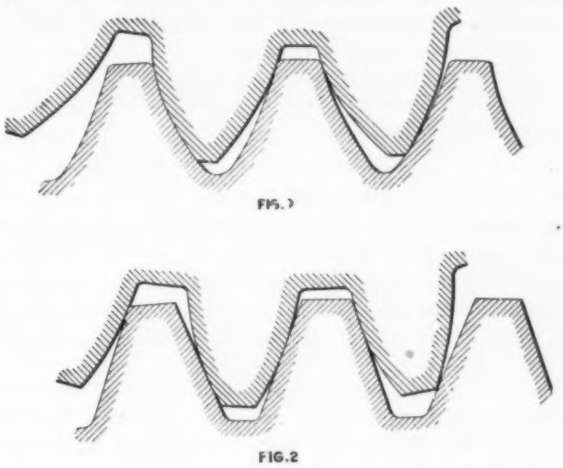


Fig. 1—Enveloping gear teeth. Pinion 30 teeth. Gear 180 teeth. Fig. 2—Standard involute teeth having 20 deg. pressure angle. Pinion 30 teeth. Gear 180 teeth

notably less than with the involute form, and, as is now well known, the lubrication is twice as efficient when lubricated surfaces roll over each other as when the relative motion is a purely sliding one.

From the above general considerations it will be seen that the form of tooth illustrated might well be expected to give a good result in practice, and this anticipation is very thoroughly borne out by the exhaustive comparative tests made by Vickers, Limited. These tests were made under ideally fair conditions. To this end, it was decided to make a double helical pinion to mesh with a double helical gear with a central gap between the two helicals. One helical pinion and wheel were cut with the firm's standard involute gear teeth, whilst the other helical pinion and wheel were cut with the Vickers' Bostock and Bramley enveloping teeth.

By this arrangement the material of the pinion and wheels was the same for both types of tooth, the mounting, alignment and lubrication were identical and, as the wheel was definitely secured against axial travel whilst the pinion shaft (driven through a flexible coupling) was free to move axially, it always adjusted itself automatically, so that the load transmitted was fairly halved between the two types of gear.

The pinion had in each case, 30 teeth of 0.673 in. circular pitch, the pitch diameter being 6.427 in. The wheels had each 89 teeth, the diameter of the pitch circle being 19.067 in. The face-width was 2 in. in each case, and the shaft centers were 12.747 in. apart. Both pinions were cut from the one solid forging of 3.5 per cent nickel steel, the carbon content of which was about 0.28 per cent. The material was oil hardened after rough machining. The heat-treated material had an ultimate tensile strength of 43.4 tons per sq.in., with an elongation of 20 per cent. Both the wheels

were also cut from one solid forging, the material being carbon steel with an ultimate strength of 34 to 38 tons per sq.in. and a 23 per cent elongation. Both gears were hobbed on the same machine and by the same operative.

Power Measurement on Test Gears

In the tests made, the gears were belt-driven. The drive was supplied by an electric motor, and the power transmitted was measured by a Heenan and Froude water-brake dynamometer. The pinion shaft made 800 and the wheel shaft 270 revolutions per minute.

Involute gearing is proportioned by Vickers on the basis of a coefficient K, which is defined by by the commonly adopted formula

$$K = \frac{\text{load in lb. per in. of face width}}{\sqrt{\text{pitch diameter of pinion.}}}$$

A common value of K for ordinary marine work is from 180 to 200, and for naval work 220. The object of the test was to compare the wear of the teeth under gradually increasing loads, and the results observed in the first series of observations made are given in Table I.

At the conclusion of this test it was decided to increase the distance between shaft centers from 12.747 in. up to 12.757 in., with the object of determining the effect of prolonged wear of the bearings. In this second test the figures given in Table II were recorded.

Table I—Comparative Test of "Enveloping" and Involute Gear Teeth

Hp.	Hours Run	K. Value	Load in lbs. per Inch of Face Width	Total Hours Run
0	18.5	0	0	18.5
18	12.[illegible]	40	110	30.5
36	19.0	90	220	49.5
55	42.5	130	340	92.0
A few pits were now distinctly showing on the involute wheel teeth. No pitting on the V., B. and B. teeth.				
74	12.0	180	460	104.0
85	20.0	205	520	124.0
91	3.5	220	560	127.5
100	10.75	240	610	138.25
A few moderate-sized pits on involute wheel teeth. Numerous small pits showing on involute pinion teeth. No pitting on the V., B. and B. teeth.				
100	5.25	240	610	143.5
120	9.0	290	740	152.5
137	20.75	330	840	173.25
More pitting showing on involute pinion. No pitting on the V., B. and B. teeth				
137	11.25	330	840	184.5
No great increase in pitting on involute pinion. No pitting on the V., B. and B. teeth.				
150	22.0	360	920	206.5
166	4.75	400	1,020	211.25
Pitting more pronounced on the involute pinion and wheel. No pitting on the V., B. and B. teeth.				
166	21.25	400	1,020	232.5
The B. and B. wheel now shows slight signs of pitting. No pitting on the teeth of the B. and B. pinion.				
182	17.5	440	1,120	250.0
Pitting worse on both involute pinion and wheel. Distinct pitting on over half the teeth of the B. & B. wheel. No pitting on the teeth of the V., B. and B. pinion.				
166	20.0	400	1,020	270.0
Pitting increasing on the involute pinion and wheel. The V., B. and B. wheel unchanged. No pitting on V., B. and B. pinion.				

Table II—Test for Determining the Effect of Prolonged Wear of Bearings

Hp.	Hours Run	K Value	Load in lb. per Inch of Face Width	Total Hours Run
85	15.0	205	520	285.0
124	15.0	300	760	300.0

The first-test figures show that pitting first appeared on the involute wheel at 55 hp., but did not develop on the "enveloping" teeth until 166 hp. was reached. It will also be noted that pitting first showed on the involute pinion at 100 hp., but the pinion with the enveloping teeth carried a load of 182 hp. without showing any signs of pitting. It appears, therefore. that under the conditions of the test, the latter carried, before pitting, three times the load of the involute wheel. —*Engineering, London.*

An Appreciation of the Work of the New England Machinists

By James Pearman
Hove, England

I read with very great interest the contribution of Guy Hubbard on page 129, Vol. 60, of the *American Machinist* concerning the tools made by The Robbins & Lawrence Co. and by The Ames Mfg. Co., Chicopee, Mass., for the Enfield Armory, England.

Whilst I was working as a toolmaker at the Royal Small Arms Works some years ago, these machines were still in use and in splendid condition.

I have often worked on milling machines that were built by Robbins & Lawrence, but the machines that were the marvel of all mechanical men, were undoubtedly those built by The Ames Mfg. Company.

In the stocking department, where the wooden components of the rifles were produced, there were a number of Ames machines in use, and they were giving very efficient service indeed, and then after having been in use for over 50 years.

One of the oldest mechanics in the place, Alex Bruce, told me that he had "set up" these machines for upwards of 30 years, and as they had been running in some cases day and night with practically no maintenance, it will be seen that they must have been a very first class job in the first instance, especially as most of them were running about 5,000 revolutions per minute.

I remember quite well when we took them down for putting on new fixtures, the bearings were like polished silver and hard as glass. The copies of these machines that have been made, fall very short of the excellence achieved in the originals. When engineers used to come for a visit to this shop, they were at once brought by the superintendent to the group of machines in question, and in every case they marvelled at their adaptability and excellence of design and workmanship.

The group of machines consisted of Blanchard turning machines, both for rough stocking and finishing; banding machines for fitting the butt into the body of the rifle; and barrel grooving machines with about six spindles for grooving the fore-ends and handguards. There were other miscellaneous form-planing and profiling machines, some of which were built with three, four and five spindles on a turret or capstan, and driven by a vertical shaft at the rear of the machine. When the turret holding the spindles was indexed from one piece to the other, the spindles came in line and connected with a loose pulley, using the same belt for the drive on each spindle in turn.

I write this as an appreciation of the marvelous work put into these machines by the early mechanics, who, without any of our modern precision appliances, accomplished an epoch marking work with their very limited and primitive means.

The design of these machines is very fine indeed, and the finish put on them is far beyond that which comes into present day work. While these machines are exceedingly light and easy to operate, time has proved that the designers were right in their calculations as regards the various proportions of the parts.

Manufacturing Silent Chain Parts

By C. J. Priebe

How the Sprocket Wheels Are Made

Second article—Standard parts for patterns—Production work in the foundry—Machining the wheels—Principles of the chain

HAVING already obtained a general view of the whole plant of the Morse Chain Co. at Ithaca, N. Y., we can now take up the different departments to study the methods of manufacture employed. It is part of the business of the concern to furnish the sprockets or wheels on which the chains run, which branch of the business requires a pattern shop and foundry.

As far as size is concerned, the pattern shop is of no great importance, as it seems to be small compared to the size of the machine plant. The reason for this is rather easy to see, since only a small portion of the company's business is in the making of castings. For many of the chains that the company furnishes, it does not provide the sprocket wheels. Also, many of the pinions are made from steel directly from bar stock.

An unusual feature of the pattern shop is the fact that it is heated by steam pipes embedded in the concrete floor. The machine equipment of the shop is about the same as that usually encountered, consisting of lathes, planers, saws and a few similar pieces of equipment. However, there is an aspect to the work of the shop that is interesting, and that is to be considered as another reason why only a small pattern shop is required. Since so much of the work is of a similar nature, a system of standard pattern parts has been evolved. Thus, gear wheels that are very similar, but differing somewhat only in width or in size of hub, need not have separate and individual patterns.

Considering a wheel of very common type, and referring to Fig. 6, the flexibility of the system can be easily seen. A given set of spokes can be used with several different diameters of rims. Additional rings can be put on the rim to increase the width of face. By sweeping out the sand in the mold a web wheel can be made, or the thickness of the rim increased. The hubs *A* have a special means of locking them to the spokes, and any style of hub can be employed.

When a split wheel is required, the hubs *B* provided with core prints are utilized. On the rim are placed the portions of pattern *C* to form the lugs for the bolts. By the use of these attached parts a casting such as shown in Fig. 7 can be obtained. The rim is split between the lugs after the machine work has been done. The small wheel for a fine-pitch chain shown lying in front of the large one gives a contrast in the sizes of wheels required.

The flexibility of this system should be particularly noted, as it enables the building up of a large number of patterns from a comparatively small number of parts. The amount of storage space for the patterns is greatly diminished in comparison to what it would be if a complete pattern were held in stock for each common size and style of wheel. As soon as the casting has been made and the pattern released, the latter is sent back to the pattern shop, where it is dis-assembled again and the parts put in the proper racks in the pattern storage room. The spoke patterns are practically always in use in the foundry.

It will be evident to the founder that the large wheel illustrated was not made in the way just described. It was cast in a dry-sand mold. A number of cores form-

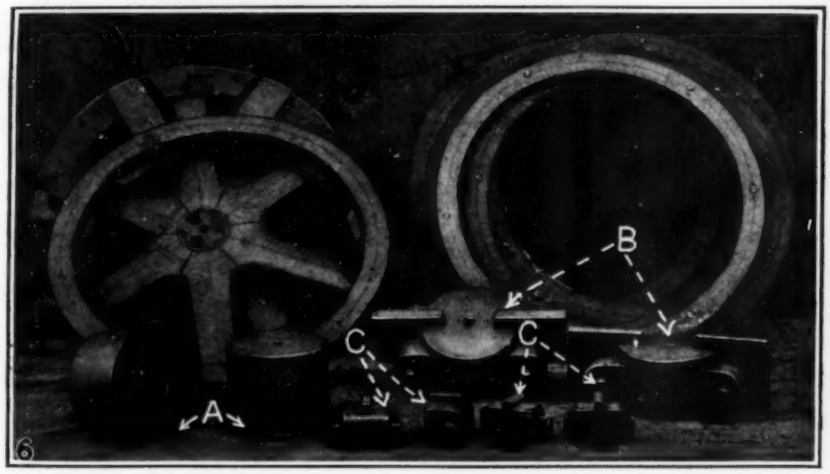


Fig. 6—Standard component parts of built-up wheel patterns. Fig. 7—Rough casting for split wheel

ing the segments of the wheel were made and then set in place in a pit in the floor of the foundry, and sand was packed around them to hold the cores in place.

Next to the pattern shop and back of the main machine shop is located the foundry building. Both the building and its equipment are strictly modern; the monitor style of roof gives a large amount of light over the entire floor area. An overhead traveling crane of 30 tons capacity is provided. The arrangement is well shown in the view in Fig. 8, with the two cupolas in the compartment at the right. The average daily heat is 10 tons.

Fig. 8 — General view inside the foundry

The work of the foundry is very largely of the job type, because practically each order must be made to some special specifications. However, because of the fact that most of the work is on sprocket wheels, there is enough similarity to allow the use of production methods. The iron and steel flasks should be noted. A squeezer-type molding machine is used for small work.

Foundry Materials Conveniently Stored

It should be noted that the railroad siding shown previously in Fig. 4 is on the same side of the building as the cupolas, and that the storage chutes are located there also. Core sand and molding sand are at the level of the foundry floor, while coke is on the charging level. Pig iron is in the storage yard on the charging level.

The castings are cleaned by sand blasting in a small house separate from the foundry, and are brought across the railroad siding to the main building, where the machining department for this class of work is conveniently located. The crane bay where the sprockets and pinions are machined shows up very well in Fig. 9; it is 488 ft. long, 30 ft. wide and as high as three stories of the shop. It is provided with a traveling crane of 20 tons capacity. One of the most noticeable features is the excellent light. On the right there are two raised floors where the toolroom and assembling departments are located.

It should be noted that the boring and turning equipment is arranged along the left side of the bay, and the gear-cutting equipment on the right. Individual motor drive through silent chain is employed on several of the larger boring mills and drive from a lineshaft under the floor for the other machines. Some of the machines have silent chains running on cone sprockets to give five changes of speed.

There are about twenty-four boring mills; the maximum work for them seldom exceeds 8 ft. in diameter. The largest machine, of Niles-Bement-Pond make and having a capacity when the housings are moved out for work up to 16 ft. in diameter by 4 ft. in height, can be seen in Fig. 10 machining the large wheel that was illustrated in Fig. 7. A rack with bars and a small hacksaw can be observed at the right, as well as a number of pieces in the foreground cut off for making steel pinions. The cranes inside and outside provide for handling the large bars up to 18 in. in diameter from the storage yards. Small wheels are ordinarily machined on Gisholt turret lathes, which are located underneath the balcony. Miscellaneous sizes of wheels in small quantities are turned on engine lathes.

After the blanks have been turned, they are simply rolled across the aisle to the gear cutting machines, where the teeth are cut. The equipment here consists

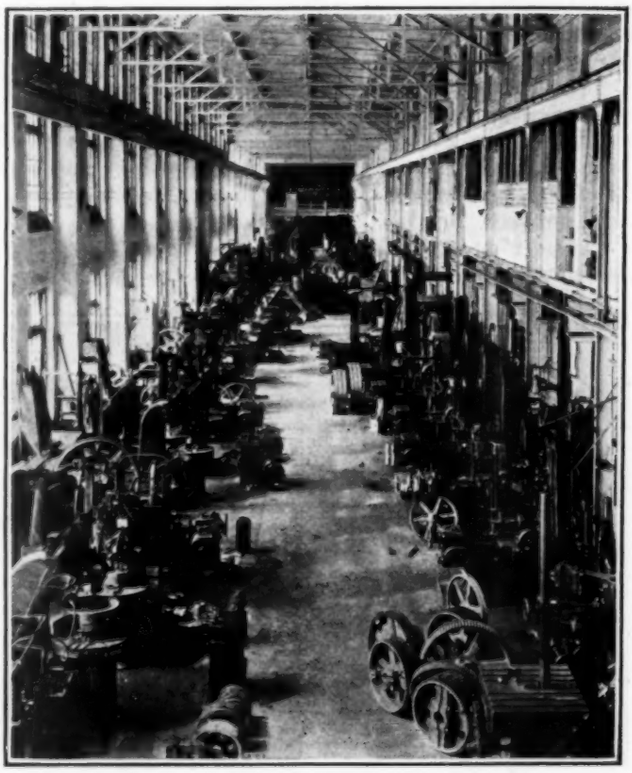
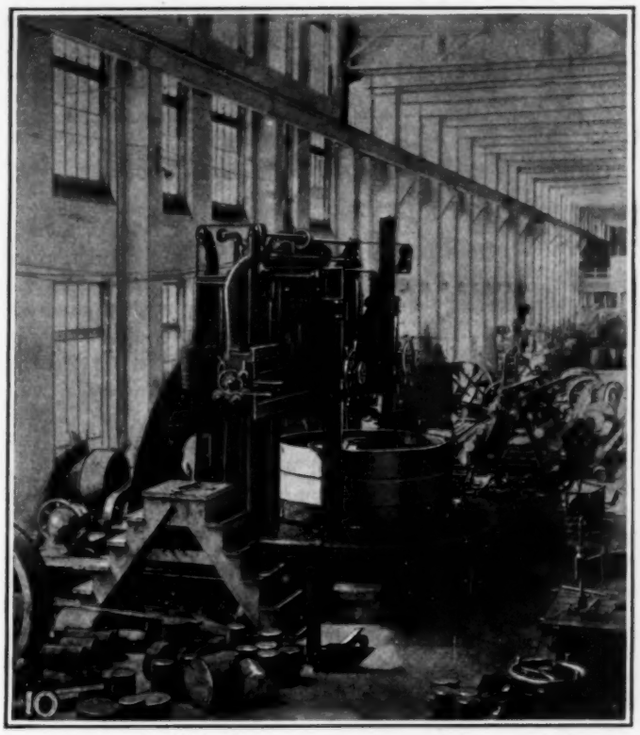


Fig. 9—Crane aisle in machine shop



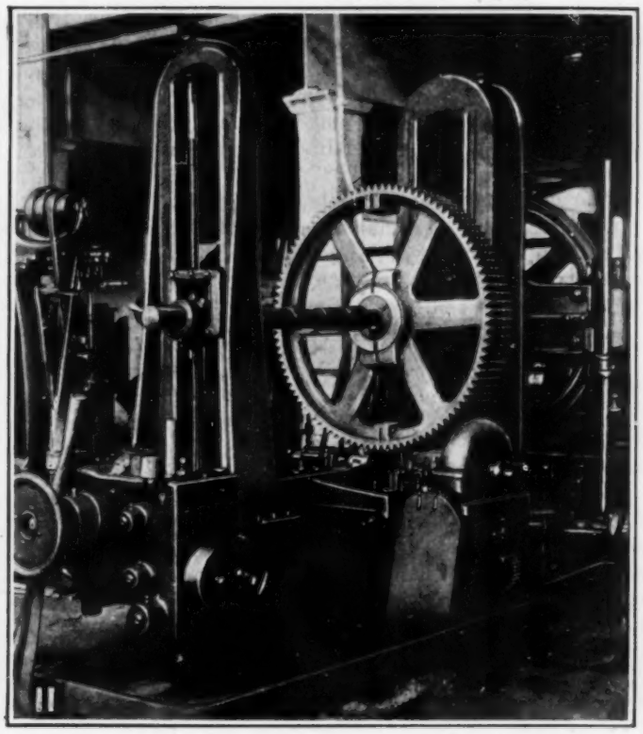


Fig. 10—Boring and turning large wheel. Fig. 11—Sprocket teeth being cut on Gould & Eberhardt gear cutter

of seventeen Gould & Eberhardt and one Brown & Sharpe gear cutters, and a Gleason gear planer for work up to 16 ft. in diameter and 4 ft. face. Pinions as small as ⅜ in. pitch, 1¼ in. outside diameter and ⅜ in. face are also cut in the department. Fig. 11 shows the teeth of a 3-ft. wheel being cut, the job requiring no unusual equipment nor differing from standard practice.

The usual gaging methods are employed in testing the teeth after they have been cut, and an additional kink which cannot be used when cutting the teeth of spur gears. The operator of the machine merely places

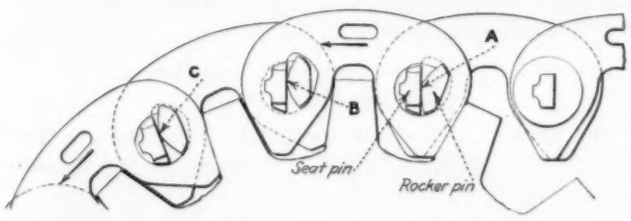


Fig. 12—Action of rocker joint in Morse chain

a standard piece of chain on the teeth of the wheel while the latter is in the machine, to see how well the parts fit.

Steel pinions are hardened in the hardening room in the usual manner after cutting, a cyanide bath being employed to prevent scaling. A number of internal grinders are used for grinding the bores in pinions and small wheels, the sprocket wheel being chucked by the teeth to insure concentricity.

Design of the Chain

Before going into the story of the manufacture of the chain, some idea as to the construction of it should be given. The chain consists of flat links having teeth at each end and strung on pins. It is the design of this pin or joint that is interesting in the Morse chain. Each joint consists of two pins, between which the relative movement occurs. There is no sliding action on the pins, and wear is practically eliminated. The mechanical efficiency of operation is stated to be nearly 99 per cent. The chain is made in stock pitches from ⅜ to 3 in. in length, and can be built up as wide as desired.

By referring to the sketch in Fig. 12 it will be noted that there is one pin having a plane surface on its face and designated the seat pin. The mating pin is known as the rocker pin, and has a curved surface contacting with the seat pin. In one end of each link is secured a rocker pin and in the other a seat pin, the shapes of the pins and the holes in the links being such as to prevent movement of these fixed pins. Clearance is provided in the link for the pins mating with the fixed pins.

It will be noted that when the chain is straight and pulling between the two sprocket wheels there is a flat bearing surface *A* of considerable area between the two pins, which thus prevents the unit pressure on them from becoming too great. When the chain is bent around the wheel the rocker pin rolls on the seat pin without sliding on it, giving line contact as at *B* and *C*. As with all silent chain the angle of the tooth face is greater than the angle of slip, so that the chain tends to rise on the sprocket teeth the same amount all around the wheel. All the teeth of the wheel in mesh with the chain take an equal share of the load.

The chain is kept from slipping off the sprockets by guide links, of which there are one or two rows. This type of link is similar to the others except that it has no teeth and extends into the tooth space of the chain. A groove is cut through the teeth entirely around the sprocket wheel, into which groove the guide link fits.

It will be noticed that when adding to or subtracting from the length of a chain, it is necessary to either add or remove two links at a time. There are occasions when it is necessary to add or subtract only one link, where a certain length of chain at a given pitch is re-

quired. Under such circumstances a "hunting link" is employed. One end of such a link is forked, so that the mating link fits inside it. In this way a connection can be made between the two ends of a chain having an odd number of links, and yet leave no offset in the chain. Naturally the hunting links are made in small quantities only.

The chain must ordinarily be run so that the seat pin is ahead of its mating rocker. It is usually of advantage to do the driving with the lower strand, just as is frequently done on belt drives. A slight amount of slack in the chain is desirable.

Sprocket wheel diameters can vary greatly, and either iron or steel can be employed. Where either the driving or the driven shaft is subject to shocks that produce an intermittent load, a compensating spring sprocket can be used. Sprockets with shearing pins can also be employed.

Chain should ordinarily be lubricated with grease and covered to prevent an excessive amount of dirt and foreign matter from reaching the joints. The covers are needed to give safety, also, but not to hold a bath of oil in which the chain should run. Making covers provides work for a large department; naturally each cover must be especially constructed to suit its drive. Large numbers of small covers are drawn to shape or the flat pieces blanked out on a large punch press. Larger ones are generally cut from the plate by means of rotary shears and the parts welded together by oxy-acetylene torches.

Shop-Made Lantern Slides

By Sidney K. Eastwood

Lantern slides for the weekly shop talks instead of the usual blackboard sketches and diagrams can easily be made without calling in the aid of a photographer and waiting for deliveries. In an isolated machine shop, the foreman of which did not care to purchase photographic equipment to make slides from drawings, and charts, the problem was worked out by the shop draftsman.

His method was to make miniature drawings on thin tracing paper, using black india ink and making heavy lines throughout. These drawings were mounted between two pieces of glass purchased at a local hardware store. The edges of the glass were fastened together with a gummed paper such as is used by merchants for wrapping parcels. The results were satisfactory and when thrown on a screen gave large scale sketches and charts that surpassed the crude blackboard sketches formerly used.

Slides made as outlined above are cheaper and can be made more quickly than by the photographic method.

The foreman who studies shop management methods will soon learn that no one rule fits all shops, that hard and fast adherence to certain methods under all circumstances may spell disaster. Each shop has its own problems and they should be carefully studied. The foreman should proceed very slowly in changing methods or introducing new practices until he has carefully gone over all the reasons for those in use and studied their good points, if they have any. And he should not be too proud to ask questions about them, of the men as well as of the management.

Motor Shop Problems

Cost of Handling Material

By Frank C. Hudson

MANY of us have been so taken up with attempts to reduce the cost of machining parts that we have overlooked other opportunities for economy which frequently run up into considerable money. One of the most glaring examples was recently seen in the handling of frames at a good sized plant, where a well known car of moderate price is made.

The frames come from a large frame manufacturer and are delivered from the car to a spot designated by the receiving clerk. From here they are carted by trucks to a platform and thence by hand truck into the shop and to the beginning of the chassis assembly.

This arrangement makes a lot of handling, takes a lot of time and, worst of all from the economic standpoint, it foots up a total cost of 60 cents per frame. It doesn't seem possible but that is what the cost sheet shows. And quite incidentally this isn't very far from being one per cent of the total direct labor cost of the car.

Just why the frames are unloaded at a point which requires trucking afterwards, isn't clear, but they are. The whole layout will probably be changed and the cost considerably reduced, if indeed it has not already been done. But it shows a leak that would not be apt to occur in the machining department.

In another large shop where the cost of machining is watched most carefully, is a somewhat similar case. The difference is that the layout of the plant is responsible rather than the routing of the material. In this instance the body shop is, of necessity, at a considerable distance from the assembly line. And in spite of conveyors and other very good handling apparatus, it costs approximately 25 cents to bring a car body from the body shop to the chassis.

Quick Painting Methods Will Reduce Costs in Many Ways

The answer to the latter problem is to relocate the body shop with reference to the assembly department and this is under way.

There is also another factor that affects the cost of handling car bodies and of building them, and that is the time required to paint them. Where the paint job requires ten days, it means having a body paint shop that can hold ten times the daily output. Thirty-five hundred bodies not only take a lot of excess floor space, which costs real money, but also mean that each body must be transported a greater distance before it can join the chassis on the assembly line. And this costs money, sometimes more than we realize.

If we can cut down the time of painting bodies, as some of the newer processes give great promise of doing, we shall also cut down the cost of the initial plant, the interest on investment in an unnecessary number of bodies, and the cost of handling them to the assembly line. In other words, although machining methods vitally affect the quality of the car, the handling methods and plant layout may even more seriously affect the manufacturing costs.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Milling Curved Slots in Typewriter Parts

By J. W. Brhel

The illustrations herewith show the fixtures, attachments, and tools used to machine radial slots in key-bar segments for a well known make of typewriter. The segments, one of which is shown at *A* in Fig. 1, are of cast iron, and the slot, which is 0.073 in. to 0.075 in. wide and $\frac{7}{32}$ in. deep, is cut on an $8\frac{1}{4}$-in. radius. The slot is afterward machined at the bottom by means of a fly-cutter, to a diameter of 0.186 in., so that a wire can be passed through it. The work is done on a Milwaukee milling machine, using fixtures and cutters built by the Kearney & Trecker Corporation.

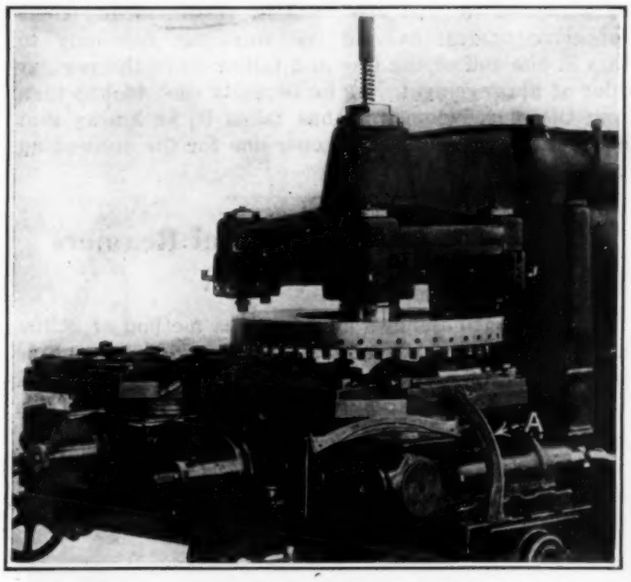


Fig. 1—Set-up for milling radial slots in typewriter segments

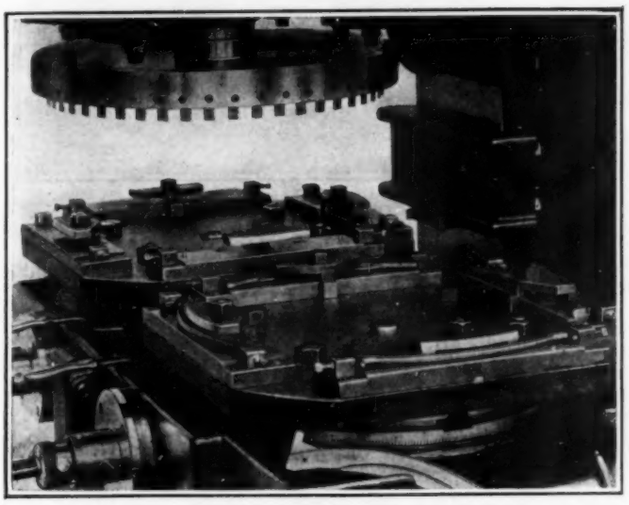


Fig. 2—View of double fixture showing clamping methods

In the first operation, four pieces are held at a time in each of the two fixtures located on the rotary tables. The cutter has 48 teeth equally spaced. The pieces are clamped into the fixtures as shown in Fig. 2, each being held by a clamp and two setscrews. The table is shifted to the proper location, which is determined by a stop, and fed upward to the cutter. One table is loaded while the other is in operation. A plug in the spindle of the machine is used to locate the table so that the stop can be properly set, the stop being used henceforth, as sufficient accuracy can be obtained in this manner, and it takes too long to set the table by the plug method. The plug is a sliding fit in the hole through the spindle, and is operated by the handle to be seen protruding from the upper end of the spindle in Fig. 1. When the table is central with the spindle, the plug will slip into the bushing in the center of the table. As stated before, the plug is used only to locate the table centrally while the stop is being set.

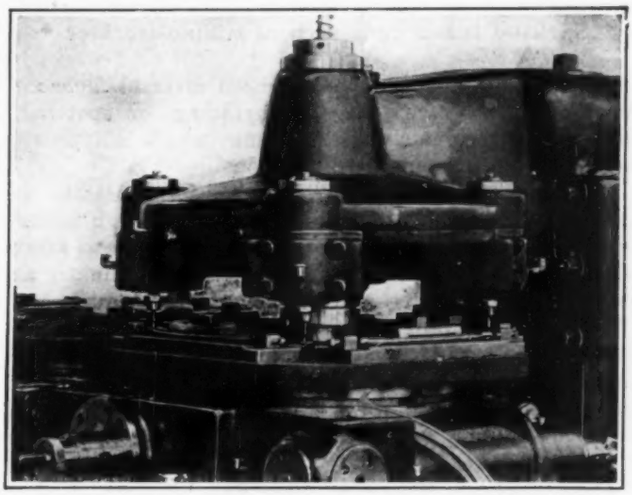


Fig. 3—Four vertical spindles operating simultaneously

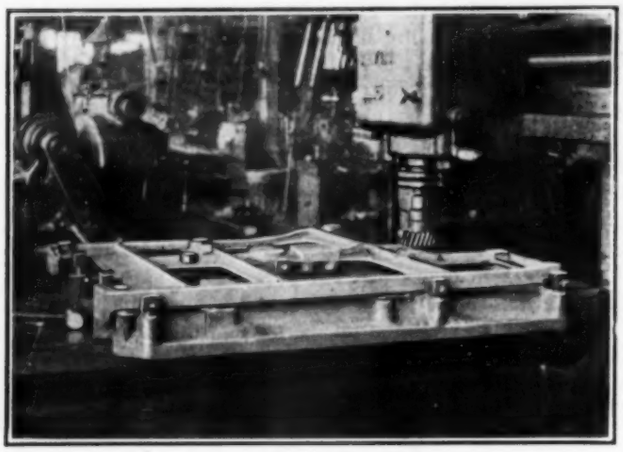
After the first operation has been completed, the cutter is removed and four small fly cutters are put into the spindle at the corners of the milling head, as shown in Fig. 3. The rotary table feed is now used, feeding $3\frac{1}{2}$ in. per min., and milling the radii in the bottoms of the four slots simultaneously. This equipment is used on a Milwaukee milling machine provided with rapid traverse, and approximately 150 pieces per hour can be produced.

Surfacing Bosses on a Vertical Milling Machine

By Herbert F. Crawford

Too many shops do not seem to appreciate the possibilities of the vertical-spindle milling machine of the profiler type. Its usefulness is by no means confined to profiling, although even this has a wider application than is sometimes realized. For milling large solid surfaces, it is not the best type of machine. But for surfacing bosses at various points on a casting it has many advantages.

The illustration shows a No. 15 Garvin vertical milling machine, in the shop of the Universal Tobacco Machine Co., Newark, N. J., surfacing, or spotting, numerous bosses on a machine frame, which is approximately 30x36 in., outside dimensions.



Spotting bosses on a vertical milling machine

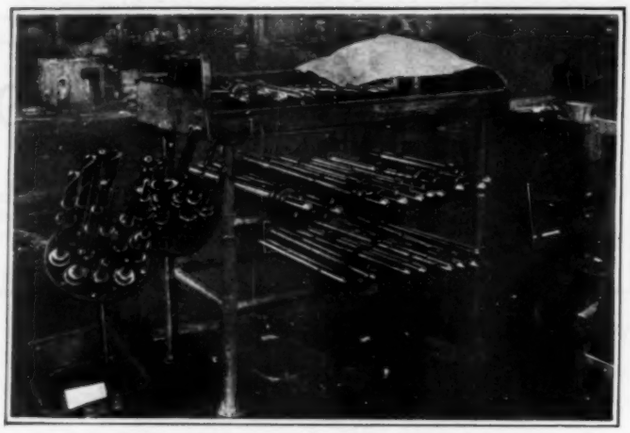
The frame is clamped as uniformly as possible on the fixture by means of side screws, then rough milled on one side, turned over and roughed on the other, after which the both sides are finished, clamping as lightly as possible. By this method the spring in the casting and that due to clamping, are both eliminated. Milling the whole piece requires approximately 45 min., floor to floor, as an average. The main requirement, however, is accuracy, not speed, as it is important that the frames be square and true.

Convenient Tool Racks for the Radial

By Jack Williams

Most jobs upon the radial drilling machine require but a few tools at most, and the job of keeping them in order between operations presents no difficulties. If there is a bench handy they may be placed upon it and picked up as needed; if not they may be allowed to lie upon the jig, the base of the machine or the floor. The operator can tell at a glance which one he wants next.

A certain part of the Bullard Mult-au-matic requires 127 operations of drilling and reaming, boring and counterboring, tapping, etc., before it is removed from the jig. The sequence of some of the operations is necessarily arbitrary, and to obtain the best results from a production standpoint it is desirable to have all of them arranged in a regular order which can be uniformly followed. Hence the temporary disposal of the tools becomes a problem for careful consideration.



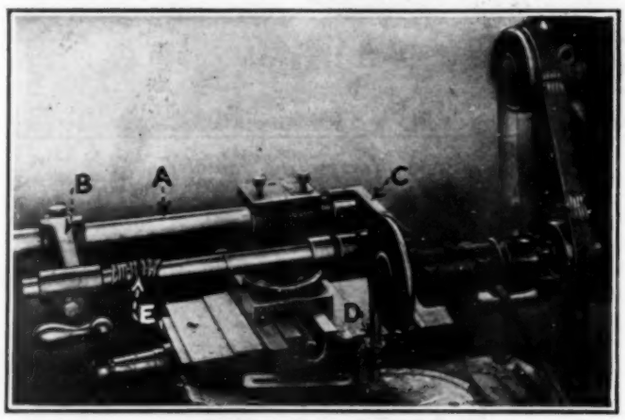
Handy racks for drills, counterbores and boring bars

The racks shown in the accompanying illustration are provided to hold the tools in readiness for their respective operations and the workman has only to start at one end of the line and follow down the regular order of arrangement. As he deposits each tool in turn from the place whence he has taken it, he knows that the next one in line is the proper one for the succeeding operation.

Fixture for Grinding Spiral Reamers

By Francis C. Henry

The illustration shows an ingenious method of utilizing a small Wilmarth and Morman grinding machine for sharpening spiral reamers. The frame or bar *A* is supported in a suitable holder and carries centers in the arms *B* and *C*, these being adjustable to suit the length of reamer and also for height. The usual type of finger rest is provided at *D*.



Grinding spiral reamers

A feature of the device is the spring at *E*. One end slips into a hole in the rear center, while the other end is so shaped as to grip the end of the reamer. The tension of the spring keeps the edges of the blades in contact with the finger rest as the reamer is moved across the face of the wheel. The spring does away with holding the blades against the finger by hand and is much more simple than the cord and overhead weight frequently employed.

Saving One Setting in Machining

By Albert A. Dowd

In turret lathe work it is often possible by the use of well designed tooling to cut out one operation, thus reducing the cost of setting up, and likewise many times insuring greater accuracy.

An example of this kind is illustrated in Fig. 1, in which the work *A* is finished on the surfaces denoted by the "*f*" marks. Ordinarily this would be a "two-setting job," the greater part of the machining being done on a turret lathe and probably the second operation by holding the work on an arbor, and finishing the other side in an engine lathe. The troublesome portions which ordinarily necessitate a second operation, are the surfaces *B* and *C*. If we design a set of chuck jaws *D*, which grip the inner surface of the flange as shown, and permit the use of tool *E* in connection with tool *F* on the cross-slide, it is evident that all necessary machining can be done with the exception of *B* and *C*. The outside turning can be done by tool *N*, and the inside recess of the flange by tool *M*, and these tools can be used in standard holders. The turning of the threaded diameter can be done by the tool indicated at *P*, and an opening die can be utilized for threading. The other operations on the work are obvious.

Now if we use a special back-facing tool as shown at *G*, it is easily possible to feed the tool *H* (which is located in a sliding block *K*) across the surface *B*, and then by drawing back the turret the shoulder *C* can be machined. The bar is designed so that pilot *Q* enters a bushing in the chuck, and end location is determined by the shoulder on the bar which strikes the face of the bushing at *R*. The tool is operated by movement of the lever *L*, suitable stops for diameter being provided.

Enlarged views, longitudinal and cross-sections of the back facing tool, which is quite out of the ordinary, both in operation and construction, are shown in Figs. 2 and 3. The bar *E* has a pilot *F*, which enters the bushing previously mentioned, and a shank *G*, which is held in a regular tool holder on the turret face. The underside of the bar is slotted for almost its entire length, as shown at *H* in the longitudinal section. The block *K* is of rectangular form and carries the special tool *L* at one end. Rack teeth are cut on the underside of the block so that they mesh with the pinion *M*. The pinion *N*, at the other end of the shaft, engages with a mutilated gear *O*, the movement of which by the lever *P*, imparts motion in a ratio of 2 to 1 to the pinion *M*, and causes the toolblock *K* to move forward across the face of the work *B*. The two pinions *M* and *N*, and shaft *Q* are one piece, and the blocks *R* and *S* serve as bearings for each end of the shaft. These blocks are fitted into the slot on the underside of the bar and held in place by the screws indicated. The mutilated gear *O* and its bearings, form a somewhat unusual construction. The body of the bar is counterbored at *T* and *U* to receive circular plugs which are cross-bored and reamed for the shaft of the mutilated gear. In assembling, the

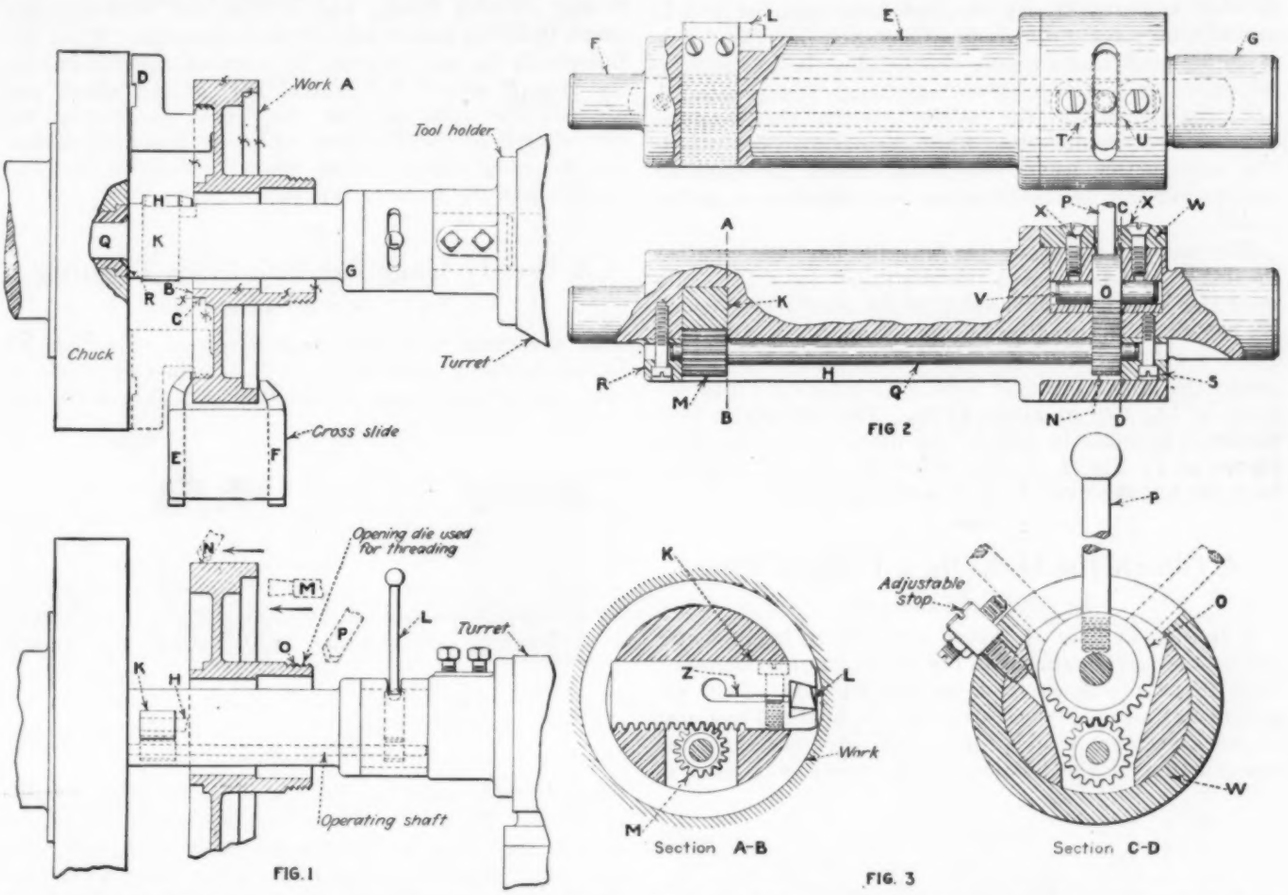


Fig. 1—Special tooling to save an extra setting. Fig. 2—Enlarged view and longitudinal section of back facing and shouldering tool. Fig. 3—Cross-sections of back facing and shouldering tool

gear is placed in the plugs, both of which are slipped down into the bar until they take the positions shown. After this, the collar *W* is forced over the end of the bar, and the screws *X* put in to complete the construction. The collar *W* covers up the working parts and strengthens this end of the bar considerably, which is necessary because considerable metal has been cut out to make room for the gears.

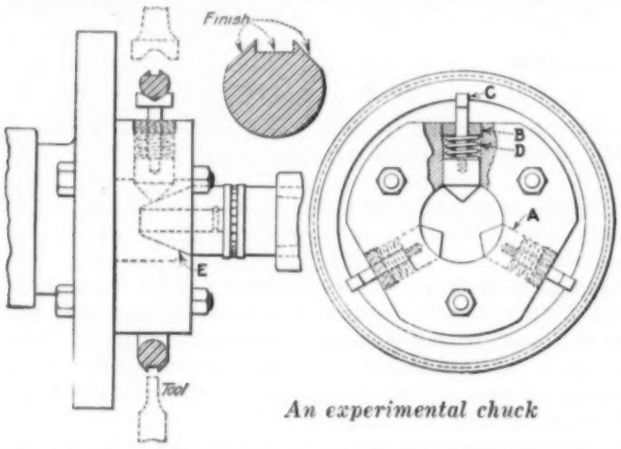
The section shown at *A-B* in Fig. 3, illustrates the method of holding the tool and shows the operation of the tool block, *K*. The end of this block is cut out to a dovetail angle of 10 deg. on each side, and the tool *L* is made to a form which fits the dovetail. The block is slotted at *Z*, and a binder screw holds the tool rigidly by pinching the two sides together. The pinion *M* has a bearing close to the toolblock, so that there is very little chance for deflection or lost motion in operation. The construction leaves very little chance for chips or dirt to get into the mechanism and interfere with its action.

The section *C-D* shows the way the bar is cut out at the other end to receive the mutilated gear *O*. This view also shows the advantage of the reinforcing collar *W*, which adds greatly to the strength of the bar. The lever *P*, can move through an arc of 90 deg., which moves the pinion one-half turn, thus producing a movement of the tool of about 1½ in. The adjustable stop makes it possible to control the diameter of the work shown at *C*, Fig. 1, so that when the turret is pulled back the shoulder can be accurately machined.

A Chuck for Holding a Forged Ring

By W. F. Sandmann

A limited number of forged rings of 10 in. diameter and of the section shown in the accompanying sketches, were to be machined, and, as the job was of an experimental nature, it was desirable to hold the tool cost to the lowest practicable limit. The sketches show the construction of the holding chuck, which was used in



An experimental chuck

an old and nearly worn-out engine lathe, long since stripped of its lead screw and other vital parts, but which was provided with a long cross-slide so that two toolposts could be used, one before and one behind the line of centers, and thus enable the work to be done in one operation.

The body of the chuck is of cast iron, bored radially in three positions 120 deg. apart to take the plungers shown at *A*, and these holes are tapped at the periphery of the body to take the short threaded plugs *B*, which were screwed into place during the assembly and serve to hold the square stems of the jaws *C* in alignment, as well as to retain the coil springs *D*, the latter being depended upon to open the chuck and release the work when the operating plug *E* is withdrawn.

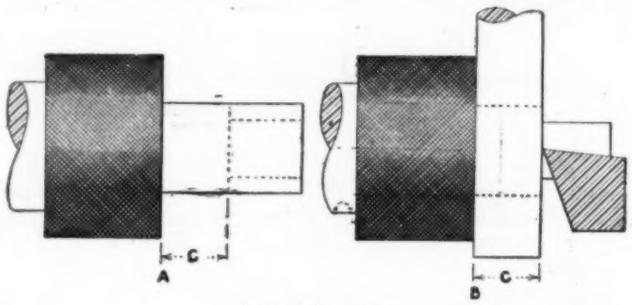
The jaws were worked down from cold-rolled steel, leaving the outer ends with V-grooves to bear against the ring to be machined, while the square stems were turned and threaded at the inner ends to be screwed into the plungers.

The conical plug *E* is fitted with ball bearings so that it may revolve freely, and is provided with a taper shank to fit the center hole of the tailspindle. When the tailspindle is run forward by turning the handwheel, the plug *E* enters the central hole of the chuck and expands the jaws against the work by forcing the conical ends of the plungers outward. Upon withdrawing the plug, the jaws are moved inward by the coil springs and the work is released.

A Handy Gage for Shoulder Turning

By Donald A. Hampson

In a certain shop they have a second operation job on hundreds of small screws. It is a precision job, in that the distance from an existing shoulder to the one



A simple gage

being turned, must not vary more than 0.001 in. plus or minus. Such jobs are ordinarily done with the aid of carriage stops, but such a process is always dependent for its accuracy on three factors: namely, a carriage that fits the ways closely and does not twist slightly as it meets the stop, no end play in the spindle, and a means of setting individual pieces so that each one registers from a given longitudinal position.

Referring to the drawing *A*, *C* is the required distance to which the new shoulder (shown dotted) must be cut from the outside shoulder of the knurled head. The screws are grasped in a collet and pressed against the latter so the inner face of the head contacts. Any variation in thickness of this head is a source of error to be combated, in addition to the three that have been mentioned in general.

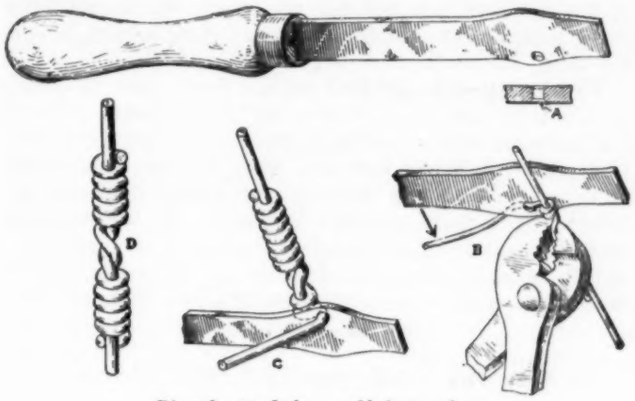
Drawing *B* shows how the second operation is gaged. A rod of a diameter equal to the shoulder distance *A* is hardened and provided with a handle of convenient shape. The workman keeps this in his left hand, "palms" it—between gagings—while he feeds the carriage up with his right hand and places it against the knurled head as shown in the sketch so that the tool strikes it and can go no farther. The rod gages *at* the critical point. It is not affected by machine inaccuracies, it is extremely simple, and it may be used while the machine is running.

Tool for Splicing Wire

By Paul Armstrong

In splicing wire, especially if it is too stiff to be twisted with an ordinary pair of pliers, the simple device here whown will be found effective.

Drill a hole in the blade of a flat screwdriver, as shown at *A*. The hole should be countersunk at each



Simple tool for splicing wire

side and, after the screwdriver has been hardened, it should be lapped to give it a smooth finish, so that the wire may slide through it freely.

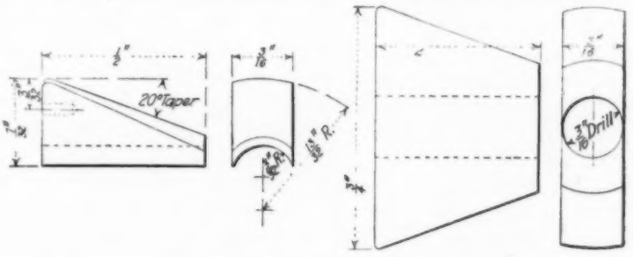
The end of one wire is passed through the hole and wound by turning the screwdriver in the direction of the arrow as at *B*, while the loose end of the other wire and the standing part of the wire being wound, are held by pliers as shown. After one side of the splice has been completed, the process is repeated with the loose end of the other wire as shown at *C*. The finished splice is indicated at *D*.

If the spliced wire is to be used for conducting an electric current, the splice should, of course, be soldered.

Machining Chuck Jaws on the Screw Machine

By Walter E. Gunnerson

The sketch shows a method adopted for machining jaws for small drill chucks. The 20-deg. taper and the $\frac{13}{32}$-in. radial dimension are the most important factors,



Making a small chuck jaw

and give us the most trouble. Each cycle of operations of the machine produces two jaws complete with the exception of the small hole in the rear end of each jaw, which is drilled in a sensitive drill press with the piece held in a gang jig.

The $\frac{7}{16}$x$\frac{3}{4}$-in. stock is held in a special collet having a rectangular shaped hole to fit the section. The first operation is to turn the taper on the outside, after which the $\frac{7}{16}$-in. hole is drilled. As this hole practically divides the stock lengthwise each operation of the cutting-off tool severs two pieces from the bar.

Babbitting Cast Iron—Discussion

By Fred Wohlert

Referring to the article under the above title by I. B. Rich, and published on page 447, Vol. 60, of the *American Machinist*, the main trouble appears to have been in making the tin stick to the cast iron.

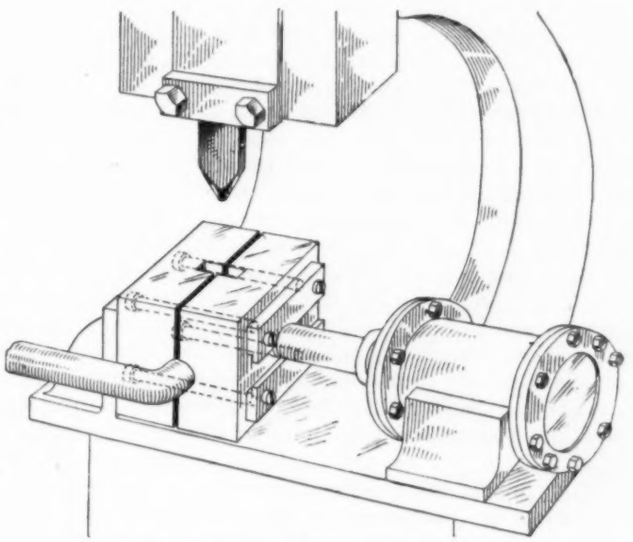
A "tin" that will stick to cast iron without coppering, may be made by melting together one pound of half-and-half solder and one-half pound of zinc. Tin the cast iron with this alloy and then go ahead with the babbitting and you will have no trouble in making the babbitt stick.

The above alloy is also an excellent solder for cast iron.

Shearing Tubes in a Punch Press

By Lee Morgan

The accompanying sketch shows a die, or pair of dies, and a punch that are used for the purpose of shearing off the ends of formed tubes of 18-gage steel,



Tools for shearing the ends of tubes

$1\frac{1}{8}$ in. in diameter. The tools are used in a punch press and the operation has superseded that of a band-sawing, by which means that ends of the tubes were formerly cut off.

One of the dies is fixed to the bolster, while the other is movable through a short distance and is operated by means of a compressed air cylinder under a pressure of 75 lb. per sq.in. The openings in the dies are of such shape that when the dies are closed, the tube is completely enclosed and held with a firm grip while the punch, or shear blade, descends through the vertical channel at right angles to the tube.

We have found that this set of tools will do the work in a perfectly satisfactory manner, and in a fraction of the time required for trimming the tubes with the band saw.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Where Do You Get Foremen?

IN ONE of the best-managed automobile plants in the country, forty of the forty-two foremen came up from the ranks in that plant. Is is any wonder that this particular organization is remarkable for its efficiency and high morale? To the ambitious machinist there could hardly be a better proof that if he is worthy of a better job he stands a good chance of getting it. He does not even have to be told about the policy of the company; concrete examples of its effects are all around him urging his best efforts.

Labor turnover is a bugbear to many a manager. But can he expect anything but a high rate of turnover if the men are convinced by the bringing in of new foremen from outside the plant that their only chance of promotion to an executive job lies in going elsewhere?

There is the danger, of course, that the appointment of foremen from the ranks will work against the introduction of new ideas from outside and tend to establish customs and traditional methods that are, or should be, obsolete. In an industry like the automobile industry the danger of such dry rot is not serious. Most of the really progressive plants are open to visitors and the ambitious foreman from one shop may learn much by visits to other shops if his company is wise enough to continue his education in this way.

Then, too, the automobile men have been generous supporters of the principle of interchange of ideas through engineering society meetings and discussions. There is no question but that much of their astounding success and progress has been due to their willingness to pool their ideas and discoveries. Even though some of the technical discussions may be beyond the mental capacity of the foreman, there is a wealth of information and inspiration to be obtained from the great bulk of them.

And, finally, the automobile shops are generally easy of access to the editors of papers like the *American Machinist*. Instructive articles can thus be obtained and printed, and the foreman has but to keep in touch with modern methods, as described in the magazines he sees regularly, to insure that he will not drop behind the procession.

The principle of promoting from within the organization is sound and must be successful if properly safeguarded.

San Francisco in 35 Hours

THE experiments conducted last summer by the Air Mail Service in night flying, to determine the feasibility of carrying mail from coast to coast at a high rate of speed, are about to bear fruit in the establishment of a continuous transcontinental mail service, beginning on July 1. The Air Mail Service has taken advantage of the experience gained last summer and is getting ready for night flying as part of the job.

It is to be regretted that the Air Mail is not as yet equipped as it should be. But bids are to be opened next month for new planes that will have a lower landing speed so as to increase the safety factor in night flying. When we consider the wonderful record the Air Mail has established, in spite of the handicap of planes not well adapted for the work, we cannot help being proud of the personnel, from top to bottom, which has made its performances possible.

With continuous air mail service from coast to coast, mail will be carried in approximately 35 hours at first, for there are to be no reckless attempts at speed records. It is quite probable, however, that the time will gradually be reduced and we may yet see 24-hour service between New York and San Francisco. It will be hard to estimate the effect of this speeding up on business, but it is all in the line of progress and will mark a decided advance step in the practical use of airplanes.

Machine Tool Standard Data Sheets

A. L. EVANS, of Cleveland, has done a good job in designing the Machine Tool Standard Data Sheets described in *American Machinist*, page 381, Vol. 60. Their use enables the machine tool builder to get to the machine tool user, in economical and standard form, all the information he needs in using the machine he buys.

The data sheets are of standard size, 11x17 inches, and of standard layout. All necessary dimensions of the machine are given—table sizes, slot sizes, spindle details, capacities, floor plans, driving details and the like. The location of the maker's serial number is indicated, and the information is tied up definitely with that number.

Any machine tool builder and any user, if he thinks a moment, will realize how many catalogs, pamphlets, blueprints and even correspondence such standard data sheets can save. If every builder will adopt them and every user will use them, the industry is going to be money in pocket.

Just Suppose

JUST suppose you had a new up-to-date, expensive machine in your shop and you wanted a man to run it and suppose you had the choice between a man who had never run a machine, and was near sighted and lame in one arm besides, but who was satisfied with $3 a day, and another man with two good arms and eyes, a good head and lots of experience with that kind of machine but who wanted $6 a day. Which one would you choose?

Well, of course, we know, and you need not answer. But now suppose you have some A1 men in your shop and you have the choice of giving them your old run down machines which cost you very little because they are almost written off the books, or on the other hand new and up-to-date machinery for which you will have to dig in your pocket or even flirt with the bank president for a loan. Which kind of machinery are you going to choose?

Ahem—errr—this is a different thing, you say. True, but just suppose

Shop Equipment News

Sellers Driving Box Boring and Facing Machine

A special purpose machine developed solely for boring and facing locomotive driving boxes has recently been placed on the market by William Sellers & Co., Philadelphia, Pa. The features of the machine are its simplicity, heavy construction, convenient arrangement and ease of operation.

The box to be machined is mounted in the chuck on the rotating table and bored and faced at the same time, thus reducing the cutting time to a minimum. If required, the box may be shifted to a new center while still clamped in the chuck, for the purpose of relieving the edges to give clearance.

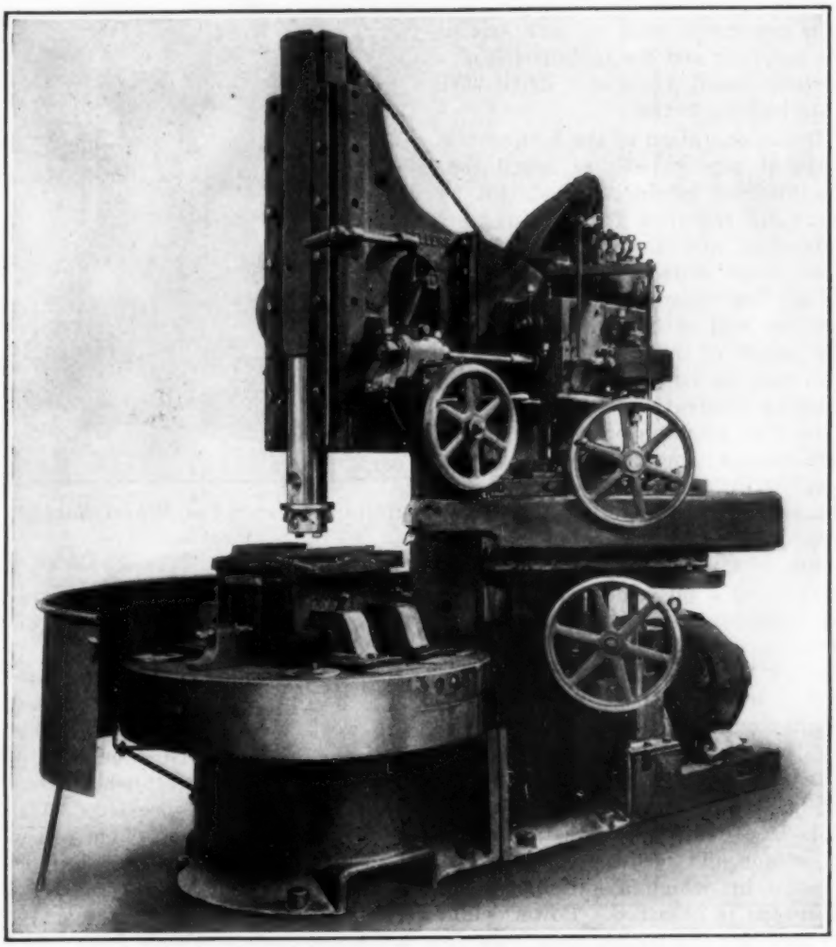
The boring bar is carried by a long rectangular steel slide, the facing head being mounted on a horizontal arm that is also rectangular in section. The horizontal arm is mounted in a massive slide that has vertical adjustment on the frame. The guides for both boring and facing bars are long and shoes are provided for taking up wear. Power feeds are provided for both bars.

The rotating table is supported on an annular bearing in which provision for ample lubrication is provided, and the large center spindle runs in a taper bushing having adjustment for wear. The spindle has a collar at its lower end to prevent lifting under heavy facing cuts.

The chuck is so arranged that boxes may be bored and faced, the edges relieved and an oil space cut in the top, all at one setting of the chuck jaws. It is not necessary to loosen any bolts or clamps, the box being held in its original position in the chuck throughout the series of operations. Two sets of jaws center the box sideways and all four jaws are operated by a single crank. A stop is provided for the top of the box so that it is, in fact, held by five jaws.

A special boring bar was developed for this machine, and is designed for the special purpose. Two sets of cutters are provided, a double-end cutter for roughing and a single-end cutter for finishing. Both sets of cutters have micrometer adjustment and means for clamping them securely in position.

The machine is preferably driven by a variable-speed d.c. motor, on account of the ease of changing speeds and the small variations obtainable. This arrangement also provides the convenience of dynamic braking for quick stopping. However, if direct current is not available, the machine can be provided with a speed change box, and driven by a constant-speed a.c. motor or from a lineshaft through the single driving pulley.



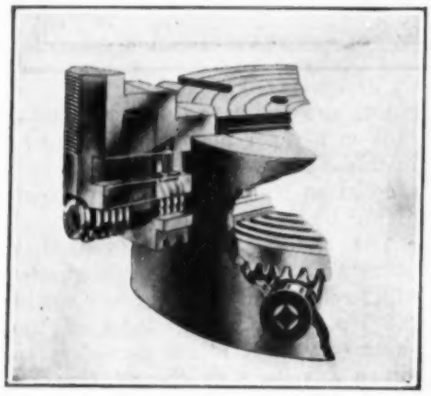
Sellers Driving Box Boring and Facing Machine

Cushman "Triplex" Chuck

A recent addition to the equipment manufactured by the Cushman Chuck Co., Hartford, Conn., consists of a chuck having both universal and independent movements of the jaws. This development is known as the "Triplex" chuck and is furnished in both three- and four-jaw types. The diameters range from 9 to 15 inches.

The accompanying illustration shows the construction by which the combined self-centering and independent features are obtained. At the base of each jaw is located

a hardened chrome-nickel screw equipped with hardened steel thrust bearings. These screws mesh with the racks beneath them and the lower surfaces of the racks engage the



Cushman "Triplex" Chuck

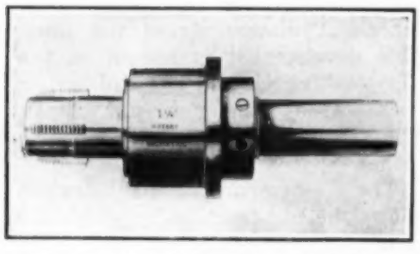
scroll as shown. When the scroll is rotated by the pinion the racks are carried in or out concentrically.

The pitch of the screw that engages the rack is $\frac{1}{8}$ inch. A spring index pin is arranged to drop into a longitudinal groove in the screw at each revolution to indicate to the operator that the jaw has moved exactly 0.200 in. The index pin provides an obstruction to the rotation of the screw that is noticeable and holds the screw stationary when in the notch.

To obtain independent action of any jaw it is only necessary to turn the screw for that jaw. All jaws can be easily brought to the concentric position by means of the screws, and can then be operated universally through the scroll. The body of the chuck is a one-piece casting and the jaws are of steel, hardened and ground to standard gages.

Geometric Adjustable Collapsing Rotary Tap

A rotary tap designed for use on hand or automatic drilling machines and multiple-spindle automatics, and also adapted for a variety of other uses, is now being marketed by the Geometric Tool Co., New Haven, Conn. The tool is shown in the accompanying illustration and is adjustable and collapsing.



Geometric Adjustable Collapsing Rotary Tap

The model equipped with the flange trip as illustrated has been designated class HB. This trip is operated by the contact of the flange with closing forks or collar attached to the machine. If it is desired to have the tripping of the tap controlled by the work, the tap is furnished with a plate trip.

There are but five units in the device, providing a simple construction. The chasers can be expanded without slowing down or stopping the machine spindle. All parts subjected to wear are hardened and ground and the chasers are removed by taking off the cap at the front of the tap. On account of its compact design the tool requires a small operating space.

Betts Improved Car Wheel Boring Machine

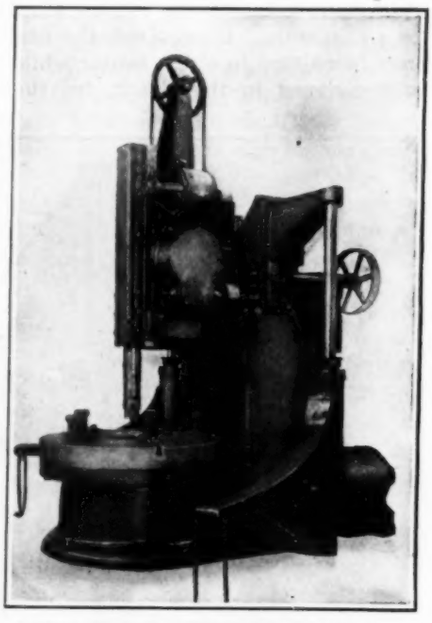
The Betts Machine Works of the Consolidated Machine Tool Corp. of America, Wilmington, Del., has recently placed on the market an improved design of its car wheel boring machine. The former model was described on page 33, Vol. 60, of the *American Machinist*.

In addition to the mechanism of the former machine, the later design incorporates features intended to make it of particular value as a high-production tool. The more important of these include the application of a pneumatic hoist on each side of the machine and the installation of a variable-speed d.c. motor drive with push-button control.

In the operation of the former machine it was sometimes found that the limit of production was set by the time required for loading and unloading, and the pneumatic hoists have been added to decrease this time. The hoists are entirely independent and each one will reach to the center of the table. Their location will be noted from the accompanying illustration.

In this machine a 20-hp., adjustable-speed d.c. motor is used for driving, the different table speeds being obtained by variation of the motor speed. The motor is operated by means of a reversible automatic controller and a push-button station located conveniently for the operator. Starting and stopping the table and opening the chuck jaws are also controlled by push buttons. A separately mounted field rheostat is used to adjust the motor speed.

In case direct current is not available the former drive can be furnished, providing a constant-speed a.c. motor and a sliding gear transmission by which a suitable range of speeds is obtained. Power rapid traverse for the boring spindle is obtained through a separate motor, the action being engaged by an automatic controller in connection with a convenient push-button station. Various feeds for roughing and finishing are obtained through sliding gears, the manipulation of two levers securing any required feed without stopping the machine. An interlock



Betts Improved Car Wheel Boring Machine

is provided between the feed and rapid traverse so that both cannot be engaged at the same time.

The automatic chuck furnished with the former machine is retained. The work is held by means of five hardened jaws that close or open as the forward or reverse push buttons, respectively, are depressed. With this type of chuck a heavy cut causes the jaws to grip the work more tightly. The table is stopped by a treadle-operated brake. The machine will accommodate wheels from 10 to 42 in. in diameter.

Myers Automatic Broaching Machine

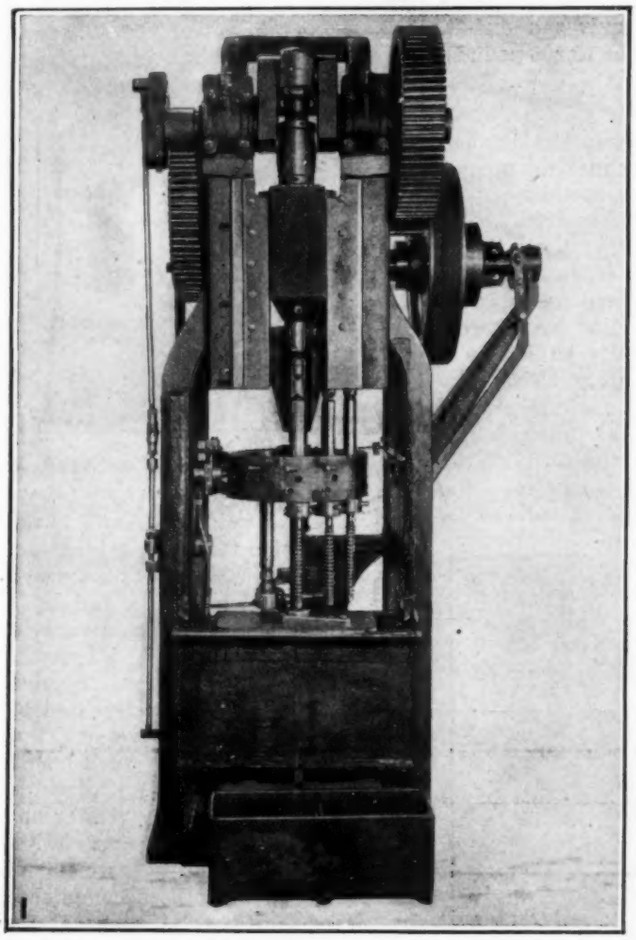
An unusual development in broaching machinery has recently been completed by the Myers Machine Tool Co., Mt. Clemens, Mich., and this company is now marketing the automatic broaching machine shown in the accompanying illustrations. The machine is of the vertical type of construction and is somewhat similar to an ordinary power press in appearance. The feature of the machine is the use of several broaches which are passed through the work in succession and are automatically returned to their working positions in the head.

The machine is intended for high-speed production purposes and special attention has been paid to the construction features that will give accuracy and speed in operation. The broaches are handled automatically and are not touched by the operator after the machine is once set. Finished holes of any desired shape can be produced by this machine, the work being held in suitable fixtures on the table.

A crank-operated ram is mounted at the top of the frame and furnishes the power for pushing the broaches through the work. The several broaches are carried in spindles mounted in a turret that revolves on a vertical shaft at the center of the machine, and are automatically presented below the ram in readiness to be pushed downward as the ram descends. A drum below the work table is mounted on the same vertical shaft as the turret and indexes with it. This drum carries a series of receiving collets that are arranged to receive the broach as it comes through the work. The vertical shaft with the turret and drum is indexed at each revolution of the crankshaft, so that a broach is presented at the working position at each stroke of the ram.

The turret is equipped with twelve spindles, as shown in Fig. 1, the twelve collets in the lower drum being shown in Fig. 2. When the broach passes into the receiving collet, it is automatically released from the upper spindle chuck and, as the ram rises, the collet drops to a position such that the upper end of the broach will clear the work as the drum and turret are indexed to the next position. The indexing is done by means of a pawl on an automatic slide, the turret turning through one-twelfth of a revolution. A positive stop locks the turret securely in the operating position.

As the drum carrying the used broaches in the collets turns, the broaches are brought in succession above a sliding rod at the back of the machine. This rod raises the broach until its upper end enters the chuck in the turret spindle, after which the spindle rises to its operating position where it is locked. Thus each broach is carried to the operating position under the ram by the spindle chuck, is then pushed through the work and picked up by the collet below, after which it is automatically returned to the spindle in the manner just described. If a broach breaks or the operation of the machine is interrupted in any other way so that the broach does not enter the



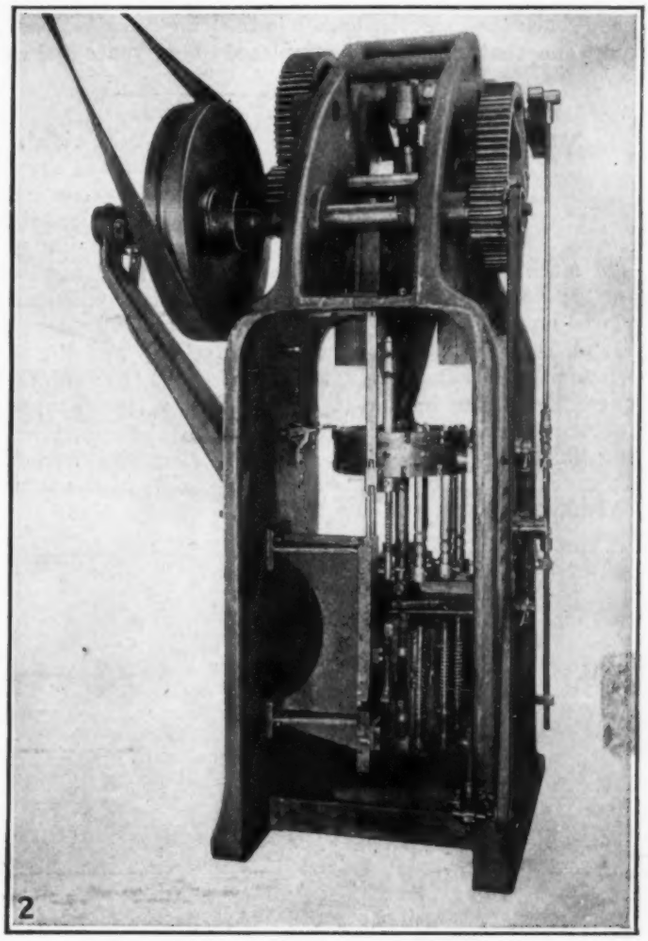


Fig. 1—Myers Automatic Broaching Machine. Fig. 2—Rear view showing turret

collet properly, the turret will not be indexed. The presence of the broach in the collet is required to keep the machine in operation, but the apparatus can be set to stop automatically after any predetermined number of broaches have passed through the work.

The machine illustrated uses broaches 12 in. in length, so that 12 ft. of cutting length are available for finishing a hole. If this length is not required for an operation, a number of pieces can be broached at one cycle of the machine. For instance, if the piece can be completed with four broaches three pieces can be finished at each revolution of the spindle turret. The work-holding fixture shown in Fig. 1 is made to hold one piece and is pivoted at one end, so that it may be swung clear of the table to facilitate the handling of the work. It is intended to arrange the machine with a dial feed that will automatically index after a given number of broaches have passed, the operator only being required to place the work in the dial and remove it.

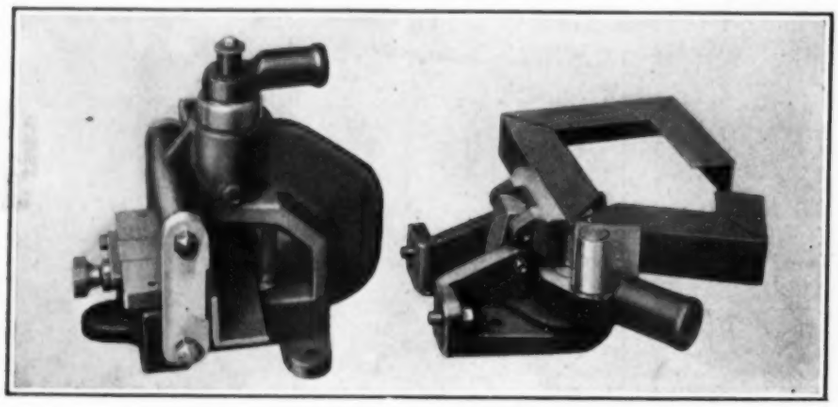
On any job that requires more than one broach the finishing broach is the only one that needs to be replaced on account of wear. The others are ground to suit the preceding position, the first one being discarded when it is worn sufficiently to prevent its use. The speed of the crank is from 36 to 48 r.p.m., depending on the job and the size of the machine, and the turret makes from three to four complete revolutions in the same time. This speed is possible largely because of the fact that the tools are handled in a vertical position, and the lubricant reaches the cutting edges of the broach throughout the working stroke.

The machine is made in four sizes, of which the smallest, No. 1, will broach holes from ½ to ¾ in. in diameter. The No. 2 machine will finish holes from ¾ to 1¼ in. in diameter, the No. 3 and No. 4 machines handling broaches up to 1¾ and 4 in. in diameter, respectively. All broaches are of the same length for a given size of machine, the shortest being 6 in. and the longest 12 in. in length. The machine is of heavy construction throughout. Either belt or motor drive will be furnished as desired. The No. 3 machine, shown in the accompanying illustrations, requires a 4x4-ft. floor space and weighs 10,200 pounds.

Whitney Angle Iron Notcher and Bender

A machine for notching and bending angle iron has recently been placed on the market by the Whitney Metal Tool Co., Rockford, Ill. The machine will handle 2 x 2 x ¼-in. angle iron or smaller and its essential features are shown in the accompanying illustration. The device is built in two parts, one for notching, shown at the left, and one for bending at the right. These sections can be fastened together making a complete unit, or either section can be used independently if desired.

All wearing parts of the notcher are hardened and it is ruggedly built to withstand hard usage. The angle is held in position by a screw clamp and the shear is guided by a pilot that enters the die. This construction insures accurate alignment of shear and work, so that the cutting blade removes the fillet of the angle at the apex of the notch. The cutting blade is made of tool steel.



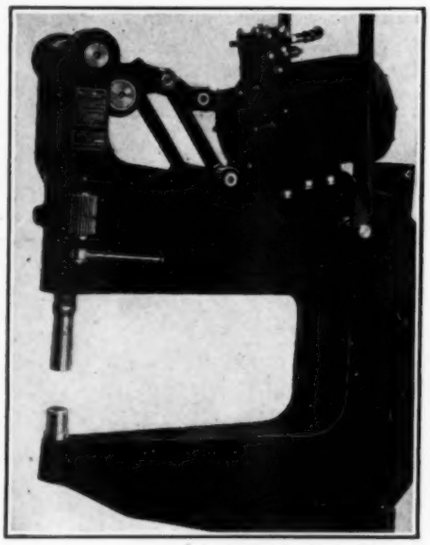
Whitney Angle Iron Notcher and Bender

The bender holds the angle against a solid jaw by means of a screw clamp. The bending shoe is pivoted on the arm carrying it so that the bend is accurately made. The method of operation of both sections of the device will be apparent from the illustration.

Hanna Die Screw Adjustment

For rapidly adjusting the die screw on its riveting machines, the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., has recently developed the accessory mechanism shown in the accompanying illustration. For ordinary variations in plate thickness, adjustment of the die screw is not necessary, but for wide variations this attachment saves considerable time and labor and provides accurate adjustment.

A large ratchet gear is rotated by a suitable ratchet handle and transmits its motion through an idler to a vertical gear. This gear is mounted on a shaft which is fastened by a pin to the upper end of the die screw. The vertical gear, the idler, the plunger, and the die screw together form a unit that is reciprocated by the mechanism of the riveter.



Hanna Die Screw Adjustment

The ratchet gear is of such length that the idler can slide on it throughout the full stroke of the riveter and remain in mesh at all times. Without this attachment adjustment of the die screw must be accomplished by means of a pair of tongs as the screw becomes too hot to turn by hand.

Bickford Pipe Tap Thread Milling Machine

A redesigned and improved model of its thread milling machine for pipe taps has recently been placed on the market by the O. S. Bickford & Son Co., 243 Silver St., Greenfield, Mass This machine threads the tap completely at one revolution of the tap and produces a relieved thread. The original features of the machine remain intact in the improved design, the changes being such as to increase the rigidity of the machine and decrease chatter and vibration.

A general view of the mechanism is given in Fig. 1 and the details are shown more clearly in the closer view, Fig. 2. Upon the heavy rod *C* are mounted two brackets *B* and *A* for the work spindle and tail center, respectively. The rod is 3¼ in. in diameter and the brackets are adjustable longitudinally upon it. Besides the tail center, the bracket *A* also carries a steel pin that rides the relief cam *D*. The camshaft *E* is located parallel to the rod *C* and to it is keyed the long gear *F* that drives the work spindle through an idler, as shown. The tap is located at *G* with its shank end secured in the spindle, and revolves at the same speed as the relief cam, so that the rise of the cam produces the proper relief on the tap.

The end of the camshaft carries a lead screw *H*, with which the half-nuts *I* are engaged. These half-nuts are secured to a bracket on the main bar so that the work moves ahead as the camshaft revolves, producing the proper lead on the tap. The main spindle for the milling cutter *J* is driven by worm gearing from the driving pulley shaft, and another worm on this shaft drives the camshaft through change gears and a vertical shaft.

The machine can also be arranged to cut the teeth on its own hob cutters, in which case the lead screw is locked to the frame of the machine instead of rotating with the camshaft, so that the hob will have no lead. The hob blank, with the spiral flutes already machined, is mounted on an arbor in place of the work and a master cutter is used to cut the teeth. The relief is produced in the same manner as when threading a tap. After one tooth is cut the lead-screw is revolved one turn and the next tooth is machined.

The recent improvement to the machine include a third bearing for the main bar that carries the work centers. Other parts of the machine, including the spindle head, have been increased in weight, and this head is gibbed to the bed of the machine. All driving gears are now enclosed and run in grease. An extra set of feed gears have also been added, making seven changes of feed available.

The regular equipment includes relief cams, driving dogs, and lead screws for Briggs standard pipe taps in sizes from ⅛ to 4 in., together with one carbon-steel hob cutter for each pitch necessary for these sizes. The weight of the machine and its equipment is 1,850 pounds.

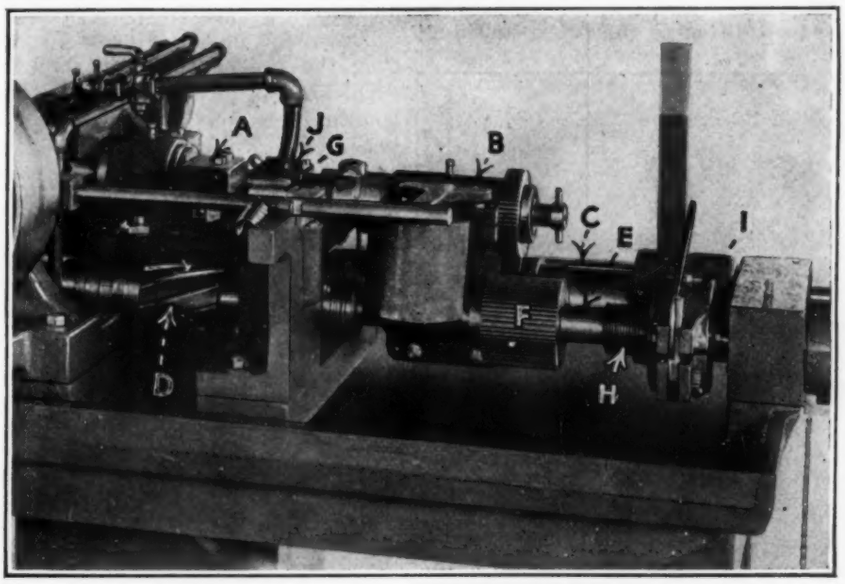


Fig. 2—Detail view of Bickford thread milling mechanism

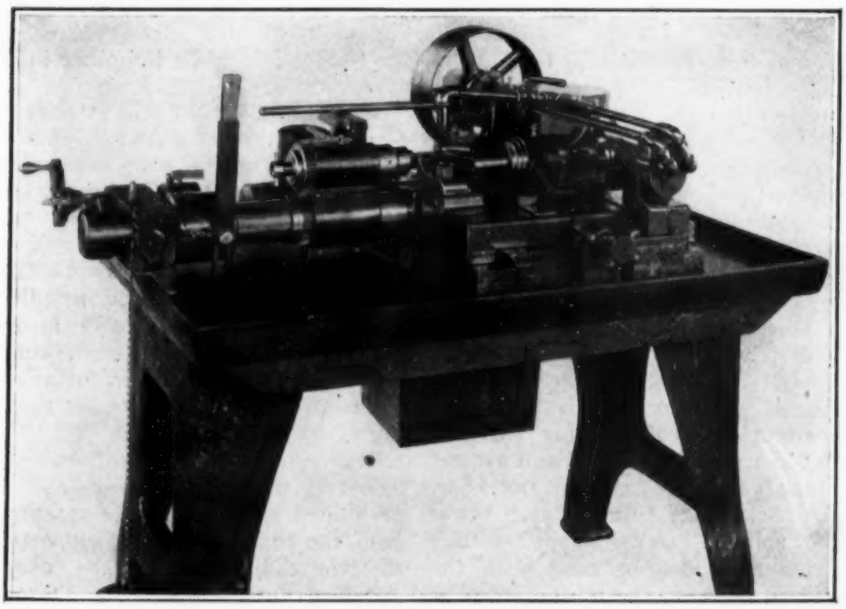


Fig. 1.—Bickford Pipe Tap Thread Milling Machine

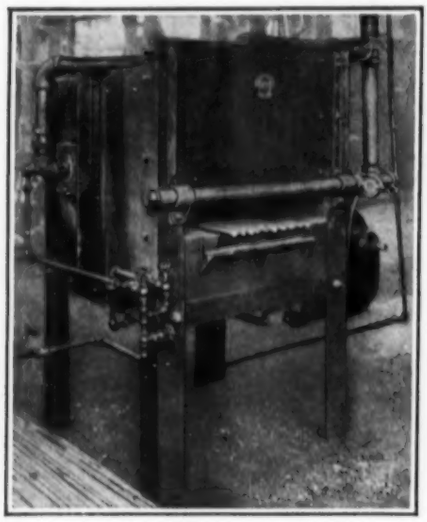
Rockwell "Economizer" Forge

A recent addition to the forging equipment manufactured by the W. S. Rockwell Co., 50 Church St., New York, N. Y., consists of the furnace shown in the accompanying illustration. The feature of this forge is the installation of a blast pipe above the furnace opening from which a current of air is blown downward across the opening and into the front of the heating space.

This blast provides a curtain of cool air between the flames of the furnace and the operator, deflecting

the hot gases away from the entrance of the forge and against a preheater located just above the entrance. The location of the blast pipe will be noted from the accompanying illustration, and the effect of the blast is to induce a current of air past the operator and into the furnace, thus providing more comfortable conditions for the operator.

In addition to the better working



Rockwell "Economizer" Forge

conditions, it is stated that the heating conditions for the metal are also improved. The hot gases are deflected against the preheater unit as mentioned above, and are then discharged above the head of the operator, the cold air passing into the preheater being heated before passing on to the burners. The direct blast from the front opening is eliminated, giving a constant pressure of hot gases upon the floor of the furnace.

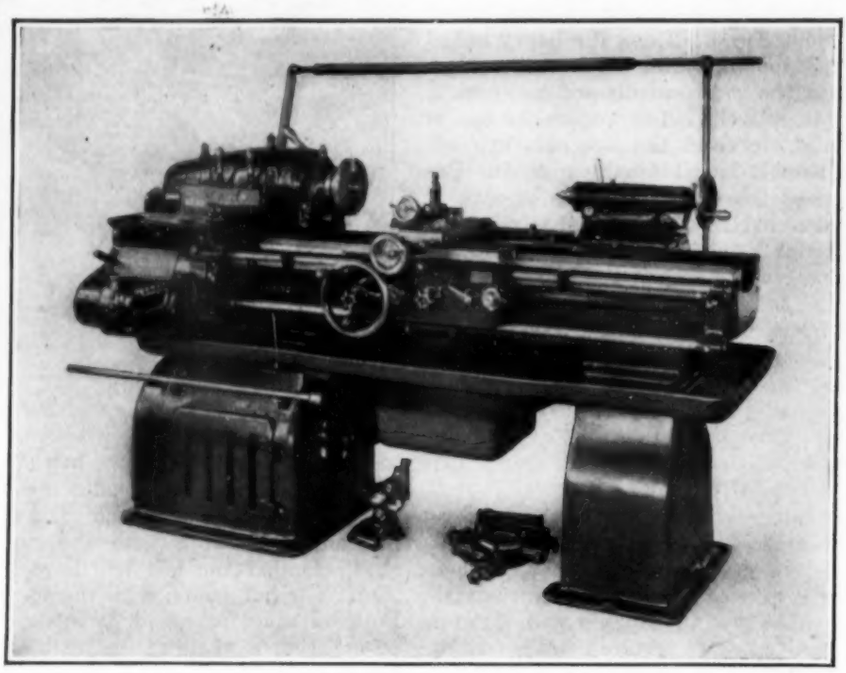
All the air delivered to the forge is controlled by a quick-acting blast gate, that permits accurate control of fire. The blast from the burner does not enter through an open hole in the furnace wall drawing in part of the air for combustion, and there is no cooling effect from cold air entering at this point.

The forge is heavily constructed and the heating chamber is lined with two thicknesses of brick to prevent leakage and store up heat in the walls. The arrangement tends to give uniform heating conditions in the furnace and produce properly heated forgings. The furnace is built in a variety of sizes and shapes to suit requirements.

Pratt & Whitney 13-In. Model B Lathe

The Model B type of lathe manufactured by the Pratt & Whitney Co., 111 Broadway, New York, N. Y., is now being marketed in a 13-in. size. This machine is similar to the 16-in. lathe of this model, a complete description of which was given on page 342, Vol. 59, of the *American Machinist*.

The swing of the lathe is 13½ in. over the bed, and the machine is furnished in 6- and 7½-ft. bed lengths. The maximum distance between centers are 32 and 50 in., respectively, for the geared head, and



Pratt & Whitney 13-in. Model B Lathe

30 and 48 in. for the cone head. The lathe is designed primarily for a motor drive, the motor being located in the cabinet leg under the headstock where it is out of the way and its low center of gravity reduces the vibration of the machine. A 3-hp. motor is regularly installed and is equipped with a convenient push-button control.

The motor is belted to the head and drives the machine through a Carlyle-Johnson friction clutch. The geared headstock provides eight changes of speed ranging from 18 to 525 r.p.m. Hardened and ground Maag gears are used in the head, the back gears being located below the spindle. A single-pulley belt drive may also be used with the geared head, or the machine can be furnished with a cone head having a four-step cone pulley. The hole through the spindle is 1⅛ in. in diameter, and the taper hole in the nose is ground to a No. 13 Jarno taper.

The gear box is fitted with a direct-reading index plate and any desired thread or feed can be set by placing two levers in the correct relation to the plate. There are 36 feeds, ranging from 0.0012 to 0.0665 in. per revolution of the spindle. Both lead screw and feed rod are provided, a small gear-shifting device being arranged so that one of the rods is idle while the other is in operation.

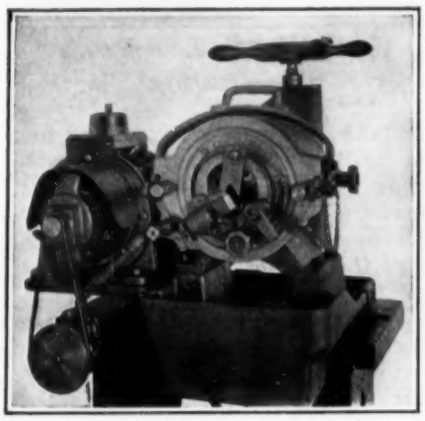
The apron is of the standard double-wall type of construction and has no bevel gears, spur gears and worm drives being used to carry the longitudinal and cross-feeds to the carriage. For convenience in long threading operations a thread chasing dial is installed, and a quick withdrawing device is also incorporated. The handwheel of the compound rest is mounted at an angle for clearance and to make the reading of the dial convenient.

The spindle of the tailstock is locked by means of a wedge and is graduated. The bed of the machine is of the box form and is supported on two cabinet legs. The usual standard and special additional equipment is available.

Forbes Portable Pipe Cutting and Threading Machine

The Curtis & Curtis Co., 900 Railroad Ave., Bridgeport, Conn., is now marketing a portable model of the Forbes pipe cutting and threading machine. This machine is self-contained and motor-driven, its weight being such that it can be transported to the work.

The feature of the machine is the stationary vise used to hold the pipe,



Forbes Portable Pipe Cutting and Threading Machine

so that the heavy pipe is not revolved during the threading operation. The dies move around the stationary pipe in this device, and it is claimed that this arrangement provides a light machine that requires a minimum of power. The action of the dies in relation to the pipe is similar to a hand-operated diestock.

Since the pipe remains stationary it is also possible to thread scrap or bent pipe, the only requirement being that there is 8 in. of straight pipe on the end to go through the vise. The pipe vise has three jaws so that the pipe is automatically centered.

The power is delivered to the diehead through suitable reduction gearing from the motor. The dies are adjustable and are fitted with a release that can be set to open the dies at any predetermined point. An oil pump is belted to the motor shaft and the oil is delivered directly in front of the dies.

The machine is made in two sizes. The No. 430 has capacity for from ¼- to 2-in. right-hand threads and weighs 350 lb. with its motor. The larger machine, No. 442, will handle from 1- to 4-in. pipe and weighs 500 lb. Either machine can be attached to any convenient electric circuit, or the machine can be operated by means of a hand ratchet if electric power is not available.

"Universal" Standard Jig Bushings

The Universal Standard Co., Detroit, Mich., is now marketing a line of standardized jig bushings

"Universal" Standard Jig Bushings

through the Universal Sales Corp., 12141 Cardoni Ave., Detroit, Mich. These bushings are adapted for use in drilling and reaming operations and are furnished in three parts, including the bushing proper, the liner, and a detachable knurled head.

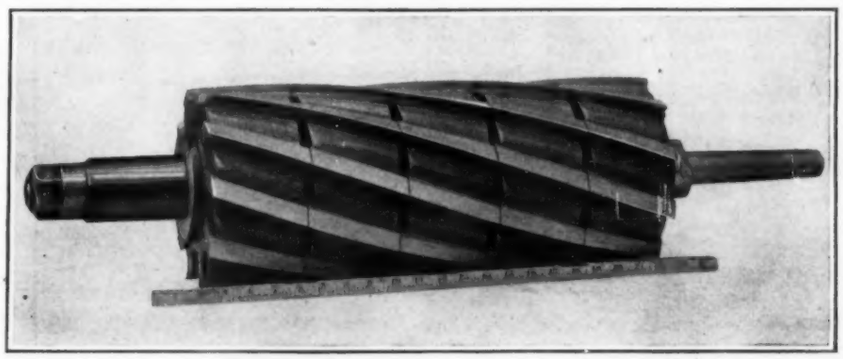
The three parts of which a standard removable bushing is made up are shown at the top in the accompanying illustration, the complete bushing appearing in the lower right-hand corner. A fixed bushing, which is the removable type without the knurled head, is also shown. The bushing proper is made of tool steel, and is hardened and accurately ground for the service.

The bushing is held in the liner by means of a bayonet type lock, that holds it securely against turning but is released by giving the bushing part of a turn to the left. This lock is so positioned that there is no chance for the entrance of dirt and grit that might interfere with its action and ease of release.

These bushings are carried in stock in 192 sizes, ranging from a No. 55 drill size to 2 in. Five different lengths are furnished for all sizes up to the ½-in., the larger sizes being furnished in six lengths. Among the advantages claimed for these standardized parts are included low cost, accuracy, and interchangeability, as well as the indirect advantages that come with the use of standardized tools and jigs.

Union Twist Drill Co. Slab Milling Cutter

A slab milling cutter with inserted helical teeth has recently been placed on the market by the Union Twist Drill Co., Athol, Mass. The cutter is designed for heavy work, its strong construction and a method for holding the blades securely in the body adapting it for such service.



Union Twist Drill Co. Slab Milling Cutter

As will be noted from the accompanying illustration, the cutter is made up by combining five separate units in proper relation to each other. The diameter of this cutter is 8 in. and its length is 20 in. The slots in which the blades are mounted are not helical but straight and the blades are secured by half-round taper pins or wedges. The body of each blade is also straight, of course, so that it will fit properly in its slot, the helical shape being milled on the cutting edges after the blades are properly positioned in the cutter body.

Cincinnati Toolroom Shaper

A recent addition to the line of shapers manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio, consists of a shaper especially adapted for toolroom use. This machine, in its essential power and control elements is the same as the Climax shaper made by this company and described on page 893, Vol. 59, of the *American Machinist*. Among these features are included an internal eight-speed transmission, cam-actuated feed, convenient controls and improved guards on ram ways and cross rail.

The toolroom shaper is furnished with a motor drive or a single-pulley belt drive. When the motor drive arrangement is used the motor is mounted at the rear of the machine and drives the machine through an endless belt. A constant-speed motor running at 1,800 r.p.m. is recommended. A ball-bearing counterweighted idler is furnished to take up the slack in the belt, and the belt is completely guarded.

The important feature of this shaper is the universal swivelling table with which it is equipped. This table is shown in Fig. 2 and is arranged to revolve around a heavy horizontal trunnion that is cast solid with the apron and extends through the whole length of the table. A worm and wormwheel operated by means of a hand crank swivels the table to any desired position, the angle being indicated by the graduated plate on the front of the trunnion. One face of the table is solid, the other face being a rocking top set well into the body of the table and pivoting on an axis at right angles to the trunnion. In Fig. 2 the tilting face is shown in the vertical position.

The tilting face is also controlled by a crank and worm gearing, clamping means being provided to hold it in any desired position and secure a solid bearing in the body of the table. The maximum angle of tilt above and below the horizontal position is 15 degrees. In adjusting this rocking surface there is no change in the mean distance between the table and the tool post, so that no loss of working distance under the tool is incurred in any position. No outer support for the table is provided, but the table is of unusually heavy construction, the apron bearing on the rail, for instance, being 6 in. wider than that of the box table furnished with the standard shapers.

Either single- or double-screw vises are furnished with the machine, and only one wrench is required for the vise, the tool post screw and the other clamping nuts for holding the work in position. The vises have swivelling bases that require only four bolts for clamping the swivel and securing the vise to the table. Automatic power feed for the head is provided, the movement being engaged and disengaged by means of a ball lever. A stop for the down feed can be set to disengage the feed at any predetermined point.

Various attachments, such as index centers, circular feeding table and cone arbor, are furnished. The machine can be operated at a speed of 138 strokes per min. on short strokes and the feeds range from 0.010 to 0.170 in. per stroke.

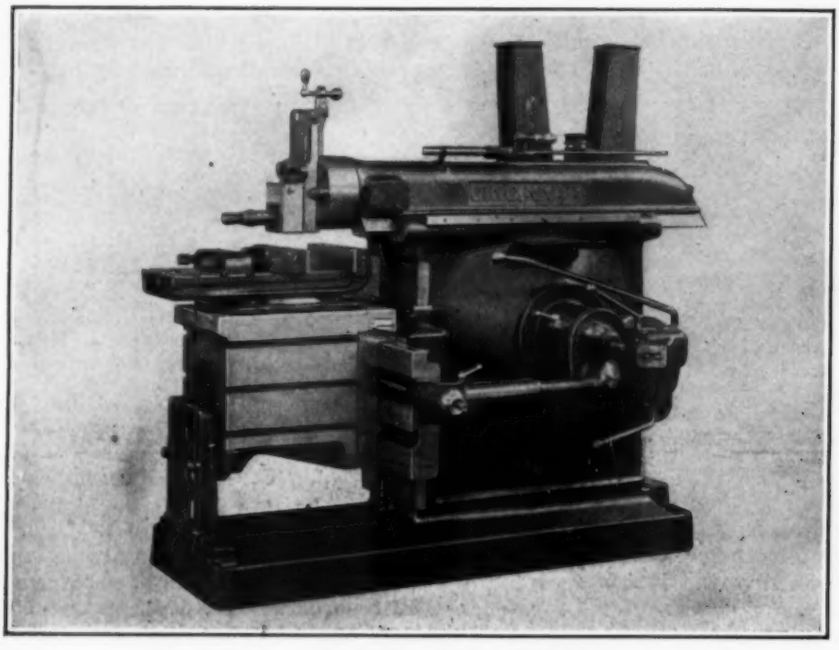


Fig. 1—Cincinnati Toolroom Shaper

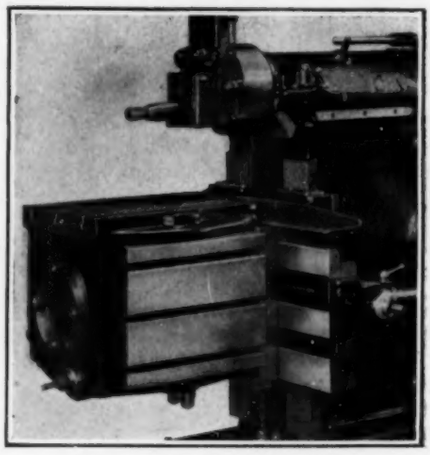
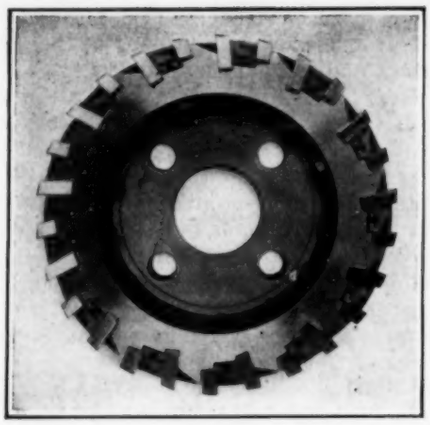


Fig. 2—Swivelling table for toolroom shaper

Modern Tool Works Face Milling Cutter

An inserted tooth face milling cutter in which all parts are hardened and ground has recently been placed on the market by the Modern Tool Works of the Consolidated Machine Tool Corp. of America, Wilmington, Del. This cutter head is designed for the use of Stellite or high-speed steel blades and the method of clamping the blades in the head is shown in the accompanying illustration.

Each slot of the cutter head holds two blades. The blades are locked securely in position by means of a two-piece clamp and a wedge bolt. The clamps bear on top of the blades and the action of the wedge therefore tends to pull the blades against the bottom of the slot, as well as to hold them securely against the sides. To remove the blades it is only necessary to loosen the nut on the end of the wedge bolt and tap the end of the bolt slightly to release the clamps. The use of the wedge for clamping makes a high degree of accuracy in the machining of the



Modern Tool Works Face Milling Cutter

blades or the cutter body unnecessary.

The blades are made with notches in the bottom that fit over a stop pin so that all blades are uniformly positioned in the cutter head. When the cutter needs regrinding all the blades are brought forward one notch, eliminating the necessity of measuring the distance through which the blades are moved. This method of adjustment for the blades does not injure the cutter body, and a new set of blades can therefore be used in the original head after the first set have been worn out.

These cutters are made with a coarse or fine pitch, designated types A and B, respectively. The regular sizes vary from 4 to 16 in. in diameter and larger sizes can be furnished, if desired.

Garvin Roller-Bearing Automatic Tapping Machine

The Garvin Machine Co., Spring and Varick Sts., New York, N. Y., is now marketing two sizes of its automatic tapping machines equipped with Timken roller bearings. The larger of the two sizes, No. 2-X, is shown in the accompanying illustration, the smaller being designated No. 1. The addition of roller bearings in this machine not only decreases the power required to drive it, but also provides a more accurate and durable mounting for the spindle.

In this tapping machine two belt pulleys rotating in opposite directions are successively engaged by a double friction clutch to produce the rotation and reversal of the spindle. In the previous design the driving pulley had a long hub that rotated in the frame bearing and through which the spindle passed. In this way the hub not only supported the pulley but also formed the bearing for the spindle so that both the spindle and its bearing revolved. The continued wear from a tight belt might cause the hub to wear in its bearing and the pulley to assume a cocked position, so that excessive friction and wear would take place in the spindle bearing.

In the later design the driving pulley is supported by roller bearings on a stationary bushing held in the frame bearing. The stationary bushing provides a long accurate bearing for the spindle, and one that is not affected by the tension of the belt. Each driving pulley is equipped with two taper roller bearings so that the thrust of the friction clutch is taken on the rollers and the thrust washers formerly provided are not necessary. The ring by which the clutch is operated is furnished with roller thrust bearings.

The stationary bushings on which the pulleys are mounted are arranged so that they can be moved vertically in the frame by means of an adjusting screw. This adjustment is provided to take up the wear of the clutches conveniently, and to insure quick and positive action at reversal. In addition to the friction pulleys, the belt idlers and the countershaft at the rear of the machine are also mounted in roller bearings.

Garvin Roller-Bearing Automatic Tapping Machine

The machine can be furnished in the single-spindle model as shown, or with two or three spindles mounted in a gang. A motor drive that incorporates a speed reducer between the motor and the countershaft can also be furnished if desired. The No. 2-X machine will tap holes up to 1 in. in diameter in cast iron, the capacity of the smaller size being for ½-in. holes. Multiple heads for tapping a number of holes at a time can be used.

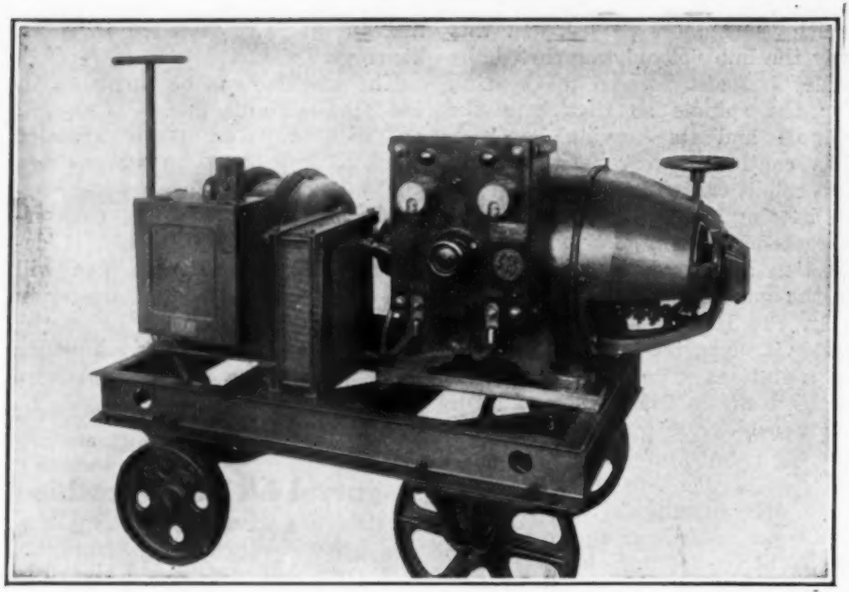
General Electric Portable Arc Welder

A portable arc welder, designed to insure smooth and rapid deposition of metal with thorough penetration, has recently been placed on the market by the General Electric Co., Schenectady, N. Y. This welder is a two-unit set, consisting of a motor and a generator, in which all regulation of current is accomplished by turning a handwheel on the generator.

A self-adjusting, stabilizing reactor is provided and steadies the arc under all welding conditions. Any of the commercial sizes of metallic electrodes from $\frac{1}{16}$ to $\frac{1}{4}$ in. in diameter can be used and the generator voltage can be adjusted to suit the character of the work. High voltage for complete penetration on heavy work and low voltage to prevent burning through on light work can be secured at will, the limits of the available current being 75 and 300 amperes.

The generator is self-excited so that a separate exciter is unnecessary. The outfit is equipped with roller-bearing wheels, has holes in the base for crane hooks, and is adjustable for long or short leads, so that the set can be located close to or at a distance from the work.

The motor and generator insulation is designed to withstand severe operating conditions both with regard to the duty cycle of the load imposed and the atmospheric conditions under which ordinary insulation fails. Bearings are packed with waste and oil cannot be spilled if the set is tipped when being moved. The generator has a dual magnetic circuit designed to operate at 60 volts on open circuit and at 20 to 25 volts under load. It is rated at 200 amperes for continuous service, 250



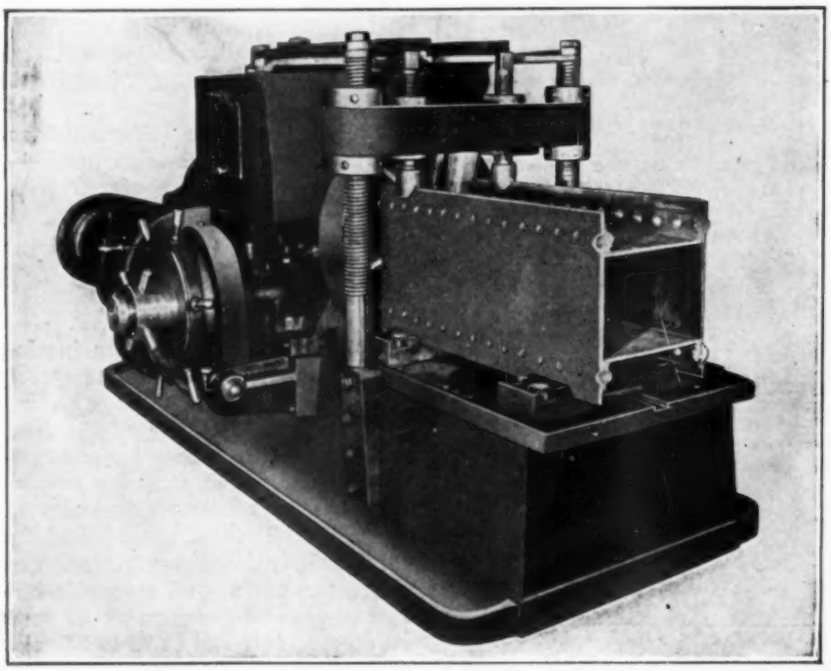
General Electric Portable Arc Welder

amperes for one hour, and 300 amperes for short periods. The motor is a standard 10-hp. unit.

All parts, including generator, motor, generator control panel, motor starter and stabilizing reactor are mounted on a welded structural steel base of rigid construction and light weight. The assembled unit is about 63 in. long, 29 in. wide and 47 in. high. Its weight is about 1,600 pounds.

Newton Heavy-Duty Column-Facing Machine

A machine for facing the ends of columns, girders and beams rapidly and accurately is now being marketed by the Newton Machine Tool Works of the Consolidated Machine Tool Corp. of America, Wilmington, Del. The machine is a modification of a rail-ending machine made by this company and described on page 917, Vol. 43, of the *American Machinist*.



Newton Heavy-Duty Column-Facing Machine

The machine has sufficient capacity for I-beam sections up to 27-in. deep, and H-columns up to the 22-in. size. The work is held in a screw yoke clamp, as shown in the accompanying illustration, or in a special type of air clamp that can be furnished. The cast-steel cutter head is 31½ in. diameter over the cutting tools, these tools being fitted in radial slots and held by wedge clamps. The spindle is a steel forging, 8 in. in diameter in the bearings and having a nose 18 in. in diameter.

The table and base are cast in one piece, oil and chip pans being provided at either side. The spindle has a 2-in. traverse, actuated through a stationary screw and revolving nut. A friction clutch provides power rapid return and both feed and return are automatically disengaged at either end of the spindle travel.

The feed and power return are both controlled by the same lever at the side of the machine, and the spindle can also be adjusted by a large hand-operated pilot wheel. The machine can be arranged for either belt or motor drive, the motor being mounted on top of the machine. A 20-hp. constant-speed motor running at 1,200 r.p.m. is recommended, but a variable-speed motor can be used if a variety of metals are to be handled.

Minor Markets for American Autos

The Automotive Division of the Department of Commerce has been making a study of markets of minor importance which offer large possibilities for the future. Synopses of the summaries for certain countries follow:

An American manufacturer is contemplating a new assembly plant in Santiago, and material for the first 200 cars is now in the country. The production schedule for the remainder of this year calls for 200 motor vehicles per month, and approximately twice as many next year. The local manager of the company believes that a large field exists in Chile for the motor truck, and predicts an increasing demand for passenger cars.

Brazilian Market

Thirty-five automobiles were imported at Rio de Janeiro in March, of which thirty-three came from the United States and one each from France and Italy. Many more entered through Santos to escape the 2 per cent gold port tax charge at Rio de Janeiro. Most of the American distributors reduced prices early in the month, making the present selling price in the thousand dollar class about 13,500 milreis. Terms of sale have not changed, most cars selling for one-half cash and the remainder in twelve monthly payments.

News of the Week

Machine Tool Builders Hear Interesting Papers at Spring Meeting

Excellently balanced program presented at convention

The spring convention of the National Machine Tool Builders' Association was held May 22, 23 and 24 at the Hotel Statler, Buffalo. An excellently balanced program made the affair a memorable one for those who attended.

On the day preceding the formal opening of the convention a number of machine tools builders and dealers met to discuss problems of mutual interest. Out of the discussion came a new trade association, details of which will be found in another column.

The feature of the business meeting held Thursday morning was the address of the president, R. E. Flanders of the Jones & Lamson Machine Co. The address was published in full in the *American Machinist* for May 22. After luncheon W. A. Viall of the Brown & Sharpe Manufacturing Co. opened the afternoon session with a keynote speech that met with considerable approval. Mr. Viall took occasion to point out that even if the machine tool industry was subject to acute depressions, it at least had the consolation of offering a creative, constructive service to civilization. He contrasted its troubles with those of other industries where practically the only consideration was money and which were consequently rather sordid.

Harry Tipper, secretary of the Class Journal Co., then made an address on the automotive market for machine tools. The address was illustrated by charts and each member received a bound copy of the comprehensive analytical study on which the address was based.

Mr. Rastall's Speech

The remaining speaker at this session was W. H. Rastall, chief of the Industrial Machinery Division, Bureau of Foreign and Domestic Commerce. Mr. Rastall's address on Europe as a market for machine tools will be published in full in the *American Machinist*.

The usual committee meetings were held Thursday evening. On Friday morning attention was turned to financial matters. P. E. Bliss, vice-president of the Warner & Swasey Co. described a method of budget control used by him in several companies. The accuracy with which sales and earnings were predicted as borne out by Mr. Bliss' statements occasioned some surprise.

Following Mr. Bliss, H. P. Dix, secretary of the Wilmarth & Norman Co., described the cost keeping system in use in his plant by which the costs for a force of over 100 men are handled by one individual. Mr. Dix's paper will appear in a later issue.

The other speaker scheduled was unable to be present and his place was taken by Mason Britton, vice-president of the McGraw-Hill Co., Inc., who delivered an address on "The buying Structure of Industry." His talk was illustrated by lantern slide charts and attracted much favorable comment.

The feature of the concluding session was a description of the system adopted at the plant of the Jones & Lamson Machine Co. to reduce overhead costs. The president of the Association, Mr. Flanders, who is responsible for the system, was the speaker. He told how his company had worked steadily to reduce labor costs until they finally discovered that overhead costs were getting disproportionately large. As a result of the system adopted, production and repair departments have been completely divorced, an assembly line much like that in vogue in automobile plants has been installed, the product has been completely re-designed and paper work has been almost eliminated. Mr. Flanders showed a number of slides to illustrate his remarks.

Many Prominent Speakers Are Heard at Meeting of Motor Men

Enthusiastic sessions held in Detroit by three associations

That the National Automotive Service Convention which was held in conjunction with the Automotive Maintenance Equipment show in Detroit last week was successful from every point of view is the verdict of all who attended. Approximately eight hundred were registered at the convention and 1,200 at the equipment show. The exhibitors numbered 105 and the exhibits practically filled the large auditorium. All machinery was in operation and a large amount of business was transacted. This was the first national meeting to which everyone who is interested in service was invited, members of co-operating associations and those of the dealer, trade and service associations throughout the country as well as others interested in rendering service to motor car owners being in attendance. Papers were read by nationally known authorities on subjects that all bore some phase of the general question, "How can we give motor car owners what they expect in the way of service at a price that will leave us a profit?"

Motion pictures and slides were used in illustrating many of the papers. A dinner was given Thursday evening by the Detroit section of the Society of Automotive Engineers to which all delegates were invited.

Among the speakers were the following: Frank R. Tate, the Tate Motor Co., Inc.. St. Louis, Mo.; J. C. Wright, director of the Federal Bureau of Vocational Education; E. M. Young, Advisory Staff of the General Motors Corp.; D. Andrews, service manager of the Continental Motors Corp.; Col. H. W. Alden, past-president of the Society of Automotive Engineers; F. C. Stanley, chief chemist and service engineer of the Raybestos Co.; H. M. Crane, president of the Society of Automotive Engineers; L. A. Danse, chief metallurgist of the Cadillac Motor Car Co.; Dr. W. K. Lewis, head of the Department of Chemical Engineering, the Massachusetts Institute of Technology and the chemical consultant of the Standard Oil Co.; Carl H. Page, director of sales, the Durant Motors of New Jersey; C. R. Comfort, president of the Comfort Printing Specialty Co.; and G. R. Fessenden, the North East Electric Co., Rochester, N. Y.

World Motor Congress

At the sessions of the World Motor Congress which were held at the Hotel Statler, Sir Henry Worth Thornton, chairman of the board of directors and president of the Canadian National railroads was the chief speaker appearing at the Wednesday session. Alvan Macauley, president of the Packard Motor Co., and T. R. Dahl, vice-president of the White Motor Co., were also speakers at the Wednesday sessions.

There were delegates from all parts of the world in attendance at this congress, many European and South American countries sending delegations of considerable number. W. Herman Slade, president of Slade, Allan & Co., Sydney, Australia, was the first speaker on the program which opened on May 21. At the same meeting John Hertz, president of the Yellow Cab Co., spoke and several discussions were held at which Abbas Wahbey Bey of Wahbey Freres, of Alexandria, Egypt, and others participated.

Triple Meeting of Supply and Machinery Men Held in Cleveland

Manufacturers and dealers combine in three-day session

Standardization of products, uniform rules for terms on sales, and the general condition of business occupied delegates to the triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association which was held in Cleveland, May 19, 20 and 21.

John C. Ruf, of I. B. Williams & Sons, Dover, N. H., was elected president of the American Supply and Machinery Manufacturers' Association succeeding Joseph M. Hottel of the Delta File Works, Philadelphia. The other officers elected were: H. D. North of the Ferry Cap & Set Screw Co., Cleveland, first vice-president; W. R. Simpson of the American Pulley Co., Philadelphia, second vice-president; D. S. Brisbin of the McKinnon Chain Co., Columbus, Ohio, third vice-president; and Frederick D. Mitchell, secretary and treasurer. The Executive Committee will be composed of the following: M. B. Skinner of the M. B. Skinner Co., Chicago, chairman; C. B. Chancellor, the Baldwin Tool Works, Parkersburg, W. Va.; Robert S. Carter, the Whitman & Barnes Manufacturing Co., Akron, Ohio; A. C. Kingston, the Mechanical Rubber Co., New York; and R. B. Skinner, the Skinner Chuck Co., New Britain, Conn.

B. H. Ackles of the T. B. Rayl Co., Detroit, was elected president of National Supply and Machinery Dealers Association. The other officers elected were: T. W. Carlyle, the Strong, Carlyle & Hammond Co., Cleveland, first vice-president in charge of machinery interests; Edward P. Welles, Charles H. Besly & Co., Chicago, Ill., second vice-president, and George Fernley, Philadelphia, secretary and treasurer. The Executive Committee is composed of the following: J. H. Ohrem, Jr., the Carey Machinery & Supply Co.; L. B. Shaw, the Machinery Supply Co.; W. O. Somers, the Somers, Fitler & Todd Co.; and J. C. Richardson, the Queen City Supply Co.

Southern Dealers' Officers

The Southern Supply & Machinery Dealers Association elected J. L. Pitts of the Brown-Roberts Hardware & Supply Co., president; George Winship, of the Fulton Supply Co., first vice-president; L. J. Larzelere of the Farquhar Machinery Co. second vice-president; and Alvin M. Smith of the Smith Courtenay Co., secretary and treasurer. The Advisory Board is composed of the following: James Biggs, the E. M. Lockett Co., chairman; W. E. Gilkerson, the Blue Field Supply Co., and J. B. Rice, the Hyman Supply Co.

While industrial conditions are sound, mills are reluctant to buy more than is absolutely necessary, members reported. There is a feeling of caution against too rapid expansion, in spite of the ease of borrowing money, they said.

The practice of giving discounts to dealers for cash payments on purchases from manufacturers drew forth varying opinions. Observance of a rule against extending this discount to dealers who ask for it on bills they have not paid on receipt of shipments was urged.

Dixon C. Williams, of the Chicago Nipple Manufacturing Co., Chicago, presided at the joint meeting of the associations held Monday. Robert S. Binkerd, New York, vice-chairman of the Eastern Railroad Presidents' Association, talked on transportation. Alvin M. Smith, Houston, Tex., secretary-treasurer of the southern association, and M. B. Skinner, Chicago, vice-president of the manufacturers' association, also spoke. Col. Leonard P. Ayres, Cleveland, assistant to the Dawes plan commission, discussed the possible effect of the reparation plan on world business and credit conditions.

On Tuesday, S. Horace Disston of Henry Disston & Sons, Philadelphia, was the chairman of the joint meeting, while addresses covering simplification of design, business sense and the qualifications of a purchasing agent were heard.

On Wednesday the introduction of the newly-elected officers and discussions embracing the subjects, "Does National Advertising Benefit the Dealer?" and "Manufacturers' Selling Cost as it Relates to Jobbers' Margin of Profit," were held. Mason Britton, vice-president of the McGraw-Hill Co. delivered the only address of the session taking for his subject "The Buying Structure of Industry."

Machine Tool Section

The machine tool section of the National Supply and Machinery Dealers' Association was held on Monday. W. J. Radcliffe of the E. A. Kinsey Co., Cincinnati, presided at this session. L. H. Swind of the Swind Machinery Co., Philadelphia, delivered an address and there were reports from various committees received. Discussions occupied most of the day and the following subjects were introduced: cost of selling and expense of rendering service to the purchaser; the best method of handling customers who wish to "trade in" used tools; some conditions which may arise in connection with conditional sales contracts; how should we advise our customers to depreciate tools? on what basis? how does such advice affect future sales? what are the most effective methods which can be used by the machine tool dealer in advertising? ways and means of training machine tool sales engineers, and general conditions respecting new machine tools carried in stock by the dealer. Question Box discussions were also held.

Immigrant Bill Bad, Says Conference Board

Serious defects in the immigration bill just passed by Congress are charged in a special report on the measure's scientific aspects by the National Industrial Conference Board of 247 Park Avenue.

The board has had a staff of research experts analyzing immigration legislation and its scientific phases since the National Immigration Conference which it initiated last year. Their conclusions, set forth for the first time for the benefit of American business and industrial interests, will be distributed to the thirty-odd industrial associations for which the conference board acts as research agency, and to the public generally.

Far from Solution

The report, which says that the nation's immigration problem is as far away from a solution as ever, pays particular attention to the work of Dr. H. H. Laughlin, of the eugenics record office of the Carnegie Institution, who was expert advisor to the Department of Labor and the House Committee which reported the preliminary immigration bill. Dr. Laughlin's conclusions summarized in his so-called "analysis of the metal and the dross in America's modern melting pot," are subjected to severe criticism by the conference board as unscientific and tending to distort the sound basis on which the eventual solution of the nation's immigration problem must be reached.

The intimation is made that the methods adopted in trying to solve the immigration problem have turned the science of biology into a game of "heads we win, tails you lose," for the immigrant.

Machine Tool Dealers Form Association

As a result of a meeting in Buffalo on May 21, between machine tool builders and dealers, there is being formed a new association of dealers. J. R. Porter of the Marshall & Huschart Machinery Co., Chicago, as acting chairman, will appoint a committee of three to draw up a constitution and by-laws.

The membership will be confined strictly to distributors of machine tools and all representative dealers will be invited to join. The membership will be limited to executives of firms and companies acting as machine tool distributors. Where such concerns handle supplies as well as machine tools the head of the machinery division of the concern will be eligible to membership in the new association.

At present some thirty firms have signified their intention of joining the association which will probably be called the National Machine Tool Distributors' Association. Further information can be obtained from Mr. Porter.

Edgerton Is Again Elected President of Manufacturers' Association

Problems of industry discussed at three-day convention

John E. Edgerton was re-elected president of the National Association of Manufacturers at the annual convention which adjourned at the Waldorf Astoria Hotel, New York City on May 21. Mr. Edgerton has served for several years and his re-election was greeted with much enthusiasm by the delegates who had been meeting for three days. Henry Abbott was also re-elected treasurer and John R. Boudinot, secretary.

This year's meeting was generally conceded to have been the most successful and best attended of any in recent years. Much business was transacted and many problems discussed. From the opening on Monday morning until the closing banquet and reception-dance on Wednesday evening, there was not an idle moment. On two of the mornings "business breakfasts" were held.

Following the reading of reports of various officers and committees on Monday afternoon, Samuel Dunn, editor of Railway Age, addressed the delegates. He stated that the entire railway system of the country was threatened with disaster at the hands of the group seeking political advantage. He said that the radicals were deliberately seeking to ruin the railroads in order to bring about their nationalization. He asserted that a real solution of the railroad problem was being made almost impossible by the persistent efforts of a certain class of public men, for political reasons, to both increase the operating expenses and decrease the freight rates from which the expenses must be paid.

Gradual Consolidation Recommended

In the report submitted by the Committee on Transportation the belief was expressed that there must eventually be a consolidation of the country's systems, but that all possible means looking toward permissive consolidation should be taken before consideration is given compulsory action.

In the business survey which is made each year by the association, it is shown that business generally is at a lower ebb this year than last year, but great hopes are expressed for the fall.

In the evening what was commonly called the "Russian symposium" was held. Opinions regarding Russia as a future market for goods from the United States differed with Isaac J. Sherman, president of the Arcos-America, Inc., claiming that within a few years Russia would be the greatest market in the world and that there had been a tremendous revival of trade under the Soviet.

Irving T. Bush declared that any move looking forward to the re-establishment of trade relations with Russia must be predicated upon a rehabilitation of credit which, he said, the Soviet had destroyed.

Dr. E. Dana Durand, chief of the Eastern European Division of the Department of Commerce said that Russia's present and future trade possibilities were greatly over-estimated.

The Open Shop committee made its report on Tuesday morning. In the report it was stated that strikes had cost the American people in the last eight years over ten billion dollars.

Charles R. Hook, vice-president and general manager of the American Rolling Mills Co., Middletown, Ohio was the speaker on Tuesday morning. His address was entitled, "Linking the Shop with the Office." His subject was of special interest to the executive present and he out forth many new ideas on factory management as practiced in this modern mill of the middle west.

Edgerton Praises Coolidge

President Edgerton's address was held on Tuesday morning following Mr. Hook's speech. Mr. Edgerton took occasion to praise President Coolidge and Secretary of the Treasury Mellon and expressed the personal hope that these men could continue in office. He stated that the coming campaign was most vital. Mr. Edgerton stated that there was an over-plus of legislation and an excess of reform at the present time.

At the noon luncheon Capt. Irving O'Hay was the humorous speaker. In the afternoon the farm problem was taken up and discussed with Finley P. Mount the chief speaker. He is the president of the Advance-Rumley Co., and chairman of the executive committee of the Farm Equipment Manufacturers' Association.

Probably the most interesting of the sessions took place on Tuesday evening when the "Platform of Industry" was introduced. The platform is most comprehensive and touches on immigration problems, labor disputes, the United States Supreme Court, association activities and other phases of business in general. Charles Cheney presided at this session as he was the chairman of the Platform of Industry Committee. It was stated that this platform will be presented to both major political parties and its adoption urged.

On Wednesday morning the committee on taxation presented its report in which it is stated that the Mellon taxation plan is the only one which offers complete and immediate relief to the intolerable tax burden.

In a resolution the action of Congress regarding the Japanese Exclusion Act was deplored and it was stated that the best method was through agreement on the subject of immigration with that country.

Eliot Wadsworth, Assistant Secretary of the Treasury, spoke upon taxation and criticized the Congressional amendments to the Mellon tax revision recommendations.

John G. Bradley, past-president of the National Coal Association, was the speaker in the afternoon. He reviewed the national coal situation especially as it touched on industry.

The following vice-presidents were elected: Pennsylvania, J. W. Rawle, Philadelphia; Massachusetts, G. E. Simmons, Fitchburg; Illinois, Robert P. Larent, Chicago; Connecticut, Clarence E. Whitney, Hartford; Michigan, John Trix, Detroit; Wisconsin, A. J. Lindemann, Milwaukee; Rhode Island, George H. Wilson, Providence; Indiana, S. C. Atkins, Indianapolis; Missouri, Harry Soullin, St. Louis; California, J. B. Miller, Oakland; Tennessee, Fred Arm, Chattanooga; and Alabama, H. T. DeBardeleben, Birmingham.

Directors at large elected were William H. Barr, Buffalo; Hays H. Clemons, Erie, Pa.; J. L. Kimbrough, Muncie, Ind.; E. B. Leigh, A. H. Malliken, Chicago; and R. W. Nelson, Jersey City.

Southern Pacific Is Expanding Shops

The Southern Pacific Railway in Texas and Louisiana has made much progress on rebuilding and extending its engine terminal shop and car repair facilities at El Paso, San Antonio and Houston in Texas, and Lafayette, La. in the past two years, and the work of modernizing and expanding its engine terminal and car and engine repair facilities on the line between New Orleans and El Paso is being continued throughout this year.

A unit containing 12 erecting pits has been added to the El Paso erecting shop and the ten stalls at the East end of the El Paso roundhouse have been extended to a length of 115 ft. 6½ in. Eight additional stalls have also been added to the West end of the original 24 stall house. At San Antonio a 100-ft. turntable has been installed, 8 stalls of the 24-stall roundhouse have been rebuilt and extended, and 3 additional stalls have been added. At the Houston general shops the construction of an additional unit of the machine shop has been completed. This is a 50x312-ft. bay which will provide space for brass and air-brake work, side rod and motion department, main tool room, small machine tools, transformers and switchboard and the foreman's office.

Work at Houston

At the H&TC shops, Houston, where the passenger power repairing is done, a larger turntable will be installed and the 18 stalls will be lengthened. At Houston work has begun on the construction of a 221-car freight car repair plant, which will include a four-track repair shed and a complete wheel and axle shop with the necessary store buildings, air brake store and shop, locker and wash rooms and office building.

The construction of a complete new and modern engine terminal and car repair plant has also been completed at Lafayette, La. The plant consists of an 80-ft. turntable serving a 16-stall roundhouse, an 80x10ft. machine shop, power house, car repair shed and the necessary buildings and offices to complete the plant. The total cost of the repairs and additions noted in these paragraphs amounts to approximately $1,650,000.

Notes of Washington Activities

By Paul Wooton

Despite reports to the contrary, no effort has been made recently, or during this session of Congress, to have the House committee on coinage, weights and measures begin hearings on the bill providing for the use of the metric system of weights and measures in the United States. The hearings on metric legislation conducted at the last session by the Senate Committee on Manufactures was so unsuccessful that it is thought to be the deterrent which has prevented any request for a hearing at the present session. It is known that Representative Vestal, of Indiana, the chairman of the House committee on coinage, weights and measures, is entirely willing that a hearing be held at any time the members favoring this legislation may request it. He states that he has no interest in initiating hearings but he has no preconceived conclusions as to the merits or the drawbacks of the legislation. His deductions as to the advisability of metric legislation will be made after he has listened to those who favor and those who oppose it.

Metric System Chances Poor

It is the opinion of those who are familiar with this situation that the chance of securing metric legislation never was poorer. The action of the Chamber of Commerce at Cleveland; the marked tendency of the Federal Government to curtail more and more its use; opposition to the proposed change by Secretary Hoover, and the failure of the effort before the Senate committee at the last session, constitute some of the reasons which seem to point to the failure of any new effort to secure favorable action on a metric bill. In previous administrations the proponents of such legislation usually had as one asset the support of the Department of Commerce. Even the Bureau of Standards now has a changed policy. Its present director has made it very clear that the bureau is in no sense a propagandist for the metric system.

Many regard the hearings before the Senate committee as one of the most decisive victories which have been won by those who oppose a change from the present system of weights and measures. The proponents of metric legislation so failed to establish their case and to answer the arguments of those who appeared against the bill that the extended hearing never was dignified by a report. Had there been any insistence for a report, it is known that it would have been a decidedly unfavorable one.

Buy Your Coal Now

An unusual situation in the coal trade is revealed by the reaction to Secretary Hoover's advice to buy now. Many of the producers of coal are not at all enthusiastic about Mr. Hoover's message and wish that he had kept still. The operators who hold this opinion believe they will be better off at the end of next winter if the consumers are allowed to go ahead, just as they are doing, and use up their stocks. This will mean that they will come rushing into the market this fall with the probability that the operators who can afford to wait will profit very much more than would have been the case had the buying been spread evenly over the summer.

A few consumers already have recognized that the hand they can play to greatest advantage is not to draw on stocks now but to continue buying their current requirements in the existing easy market and then use their stocks where prices go up in the fall or winter. Much interest is being manifested in the result of Secretary Hoover's letter. The more generally held view is that most consumers will not be able to resist the temptation of coasting on their stocks.

Interesting Charts on Auto Production

Recent charts showing automobile advancement during the period covering the motor car's existence have been sent out by the National Automobile Chamber of Commerce, New York City. The charts are exceptionally interesting to people in the automotive lines and the allied industries that supply the manufacturers. The total production by years from 1895 until the present year, the registration by years, the taxes paid in 1923 by motor car owners, and the chart shown with this article are given.

Raw Materials Used in Manufacturing Motor Vehicles During 1923

	Amount Used in Motor Vehicle Manufacturing and % of Total Production of Material
Iron and steel (tons)	3,434,800
Percent of finished rolled steel and iron output used in manufacturing cars and trucks	10.2%
Copper (pounds)	121,949,150
Percent	9.3%
Aluminum (pounds)	91,514,000
Plate glass (square feet)	47,229,500
Percent	53%
Leather (square feet)	60,000,000
Percent	69%
Rubber (pounds)	547,468,544
Percent	80%
Lumber, hardwoods (board feet)	1,163,232,000
Percent	14%
Lumber, soft wood, crating for railroad shipments and exports	300,121,000
Lead (pounds)	135,349,000
Percent	12%
Tin (tons)	7,300
Percent	10%
Nickel (pounds)	6,275,000
Paint and varnish (gallons)	14,304,500
Imitation leather (square feet)	166,319,000
Upholstery cloth (yards)	19,036,000
Top and side curtain material	30,389,000
Hair and padding (pounds)	40,870,000
Asbestos (feet)	60,000,000

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Why England's Business Is Quiet

Some machine tool firms going into other lines—War surplus still a factor—Auto manufacturers are busy—Many mechanics leaving for other countries

By Our London Correspondent

IN THE machine tool industry conditions are still at a rather low level and the writer can recall only one firm that can be reported as fully occupied. A number of engineering firms have been and are being sold up and their plant comes on the market second-hand, to be disposed of by dealers, who thus are able to continue in trade and possibly to make profits. The corporation which acquired for disposal government surplus stocks of machinery found it necessary recently to issue a statement to remove the impression that the stocks were completely sold off.

Even when it has been reported that a machine tool firm has been working overtime on orders, it will be found that the firm had already given up half or more of its shops to other work, the motor car industry having more than once proved a good friend.

The agitation regarding the Budget scheme to abolish the McKenna tariff of 33⅓ per cent on imported motor cars, etc., can have but slight effect on the machine tool industry, for most of the automobile concerns had already fully equipped themselves for the season's manufacturing program, and only an occasional tool is necessary to complete or supplement the plant.

The railway companies have ceased from placing orders of moment for this class of equipment and with the decline on the textile machinery side of engineering, the machine tool firms have been hard put to find a market of any size.

Unusual Measures

Export has been hardly any better and to help matters one firm has bought used machine tools on the Continent, where it has affiliations, brought the machines to England, attended to them in the shops, and then shipped them back, for sale as renovated tools.

Electrical engineering firms have been complaining that, while orders may be secured, prices formerly obtained cannot now be maintained. But British engineering generally would be in no bad case if it were in every section as well occupied as the electrical side. They at least have paid dividends with some regularity. Recently it was stated in Parliament by the president of the Board of Trade that during the first nine months of last year 20,509 skilled men in the metal and engineering trades left Great Britain for non-European countries, mostly the United States.

The continued depression has led to a natural result and after many months, a number of machine tool firms are fading out of the business or definitely winding up. Official receivers are busier. Several of the Yorkshire districts seem to be the worst hit in this way.

Affairs are a little more favorable regarding small tools, for which a fair demand has been steadily maintained. However, one firm of some size has stopped production, the works being sold for the manufacture of commercial vehicles, while another large firm reported recently to be well occupied is really producing about half its full output.

Various Curtailment

In one way or another, the trading conditions have brought about changes in several of the leading machine tool importers. One firm found it advisable to dispose of a new building intended for use as a warehouse, offices, etc. Another was acquired by one of the large industrial combinations effected during the boom period of a few years ago, though this makes no difference in the trading policy or methods. Another firm is moving into different premises, and so on, while smaller firms have sought for new markets for other engineering products, such as cycles.

For the first third of the year a number of the automobile firms were decidedly busy, more particularly those producing cars of the lighter types, and for the first time we have a firm manufacturing cars at a rate exceeding 1,000 a week. The export trade in cars and parts has been much brighter and for the first three months of the year showed a 50 per cent increase on the same period of last year. Arising out of the McKenna duties agitation, it has been asserted that French interests have been buying machinery here for the production in France of cheap cars for the British market. The Ford sold over here is now advertised as "All-British."

The British Empire Exhibition at Wembley has been duly opened, and if during the first week or so some of the exhibits, including engineering products, were not quite ready, this was due in a large measure to the failure to connect up electrically, owing to labor troubles. The power station itself was quite in a condition to supply current. It is definitely arranged as an exhibit, so that visitors may inspect the generating plant and see the whole process of the power house. The machine tool exhibits are not numerous, but there are a number of small tools. Presses may perhaps be mentioned, and Armstrong, Whitworth & Co. show a considerable number of machine tools, chiefly for the railway shops. A lathe may be seen in the Australian section. The reason underlying the unrepresentative character of the display in this department is well understood.

The Machine Tool Trades Association, having in view the depressed condition of the industry and the cost of an exhibition extending over six months, debarred its members from showing at Wembley. No option was given. The association also acted in the same way as regards the British Industries Fair held outside Birmingham. The association will, of course, hold its own exhibition at Olympia, London, W., in September next, and a preliminary list of 112 exhibitors has been issued.

The electrical engineering exhibits include a machine about which many rumors have circulated for a number of months in Great Britain and of which much is expected in the electrical field. It is the Highfield and Calverley transverter, shown on the stand of the English Electric Co., Ltd. Briefly its purpose is to transform and convert 3-phase current at generation pressures of say 3,000 volts or more into direct current at 100,000 volts, or higher, as desired for transmission purposes; being reversible, the machine will change the continuous current thus transmitted into alternating current of the desired voltage for distribution purposes. The machine shown is of 1,000 kw.

Machine Tool Exhibit at New Haven

It is announced by the committee in charge of the New Haven Machine Tool Exhibit that the date for the fourth annual exhibit will be Sept. 15 to 18. The exhibit will again be held in Mason Laboratory of Yale University.

The keynote of the exhibit this year will be "Greater Production," and the technical papers of the evening program as well as the exhibits are arranged with this keynote kept foremost in mind.

Recognizing the beneficial values of this exhibit, the Council of the American Society of Mechanical Engineers has approved the sponsorship of the evening program by the Machine Shop Division of this society which will arrange for the papers, discussions and publications of the proceedings as an official activity of this society.

Many exhibitors have already signified their intention of being represented at the exhibit and several of them will show models of new equipment for the first time.

The exhibit will again be run under the joint auspices of the New Haven Branch of the American Society of Mechanical Engineers, Yale University, and the New Haven Chamber of Commerce.

The committee in charge consists of the following:

H. R. Wescott, Chairman, Prof. S. W. Dudley, E. O. Waters, K. F. Lees, N. E. Horn, J. S. String, and J. D. Marsh.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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ALIENISTS say that melancholy is a mental and nervous disorder that yields but slowly to treatment and is often characterized by great irritation at any evidence of cheerfulness in others.

The experience of the writer seems to vindicate the accuracy of this statement, for he has recently received a good many letters berating him for his optimism and insisting that he was wrong in taking a cheerful view of the future. These letters remind one of the darky who answered inquiries concerning his health by saying that he was "Poorly, thank God" and then quarrelled with those who ventured to remark that he looked very well.

But even at the risk of offending the pessimists, I am impelled to again point out that there is nothing in sight to warrant the alarm by which some were apparently obsessed when Congress passed the Bonus Bill over the President's veto.

The economic history of this country shows that credit expansion and speculative distension invariably precede a period of contraction and liquidation. Because we have not had the former we cannot have the latter and, while some lessening of building activity is to be expected, it is about the only direction in which any serious slackening of enterprise is indicated. By persistently preaching pessimism the normal energies of the American people may for a time be shackled, but it is generally low water when the rocks are visible and trouble often disappears when everyone thinks it is imminent.

It is estimated that the Bonus Bill that has been passed will cost the Government about 135 million dollars a year for 20 years, but it is also estimated that the tax bill now agreed to in conference will effect a horizontal reduction of 25 per cent in this year's taxes and cut next year's tax burden by 475 millions. The latter is not an ideal measure, but if Mr. Coolidge signs it and Congress then adjourns, we may hope for a period of peace and quiet until the Presidential campaign begins in earnest in the autumn.

There is a tradition that a presidential year is always a year of business depression, but this tradition is not supported by history and it is quite possible that we may see a distinct revival of trade after the political conventions have been held and before the politicians begin their quadrennial wrangle.

Basic conditions favor this view. The hand-to-mouth buying in which most merchants have persisted for months past has left them with very small stocks of goods. Bank loans and the money market both indicate that the use of borrowed capital by business is relatively small and that inventories are shrunken within ultra-conservative limits.

Conditions in Europe are meantime improving. Gold continues to come this way. Bank clearings for last week as reported by the *Financial Chronicle* show an increase of 3.9 per cent over last year. Interest rates are falling. Call money is lending in New York at 3 per cent. Eligible acceptances running for ninety days can be sold at 3⅛ per cent and time money is freely offered at 4 per cent. The weekly statement of the Federal Reserve banks shows a reserve ratio of 83.7 per cent.

Cheap money is beckoning to enterprise and if we may judge the future by the past the invitation will not long remain unheeded.

The markets seem to sense these conditions. Stock Exchange speculators had a chill upon the passage of the Bonus Bill, but the market speedily recovered its poise and has since moved forward more aggressively than for some time. The telephone company has announced that it will sell 150 millions of its stock to its present stockholders on the installment plan, which is fairly good evidence that the financiers controlling what is now our largest private corporation are not apprehensive of the future.

Bonds, which were but little affected by the Washington news, are also firm again and new issues running to a total of well over 50 millions were successfully disposed of.

There is a better demand for steel and the reports of a lessened automobile production are in a measure discredited by the Government figures for April, which compare with previous years as follows:

	1924	1923	1922
Passenger cars	337,037	344,661	197,224
Trucks	36,102	38,085	22,665

In the shoe manufacturing business a better tone and some revival of activity is reported and leather and hides have both shown an advancing tendency. The lumber production in the Pacific Northwest also shows an increase though facts are hard to obtain with regard to the industry as a whole.

Many other reports and statistics might be adduced to show that the business of the country is holding up remarkably well and that the ultimate consumer is not as badly scared by the political development as the temperamental speculator professes to be.

It is not to be expected that the complicated mechanism of American business will ever be in perfect working order. Slight readjustments always will be necessary, but no serious slowing down seems likely as long as the vacuum created by small stocks remains unfilled and the lubricant of cheap money is at hand.

What's Doing in Industry

Reports from the machinery and machine tool markets this week show but little improvement over last week. However, more hope seems to be held out for future business and dealers say that inquiries—while of small volume—are for the more costly machines. Most producers see better buying on the part of both the railroads and the automobile shops just ahead, and there are expectations that the summer will not be as quiet as it appeared it would be a few weeks ago.

Automobile production is undeniably off at the present and the latest predictions are to the effect that the total figures for the year will be about equal to those of 1923. This is not an unsatisfactory business by any means.

The large electric industries report a slight let-up since May 1 but are not alarmed. Prospects are excellent in this line and the industry generally is in the best condition it has been in for years.

Cotton production is slow, but warehauses are empty, a condition which presages improvement during the next few weeks.

The Wall Street bulls turned politics to their advantage and made capital out of the bonus bill and other measures, thereby sending stock prices up a few points after a declining market of two weeks. However, neither industrial nor automobile stocks were much benefited by the changes.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Chicago

Business in the Chicago district for the past few weeks has been above the average, as reported by other sections of the country. However, during the last two weeks there has been considerable laying off of help in many industries, including steel, agricultural implements, and general manufacturing.

The automobile accessory manufacturers are marking time but are holding their organizations together. They seem to feel that a turn for the better will soon show.

There has been some placing of steel orders for car building. The Inland Steel Co. received an order for 40,000 tons. Some of the railroad shops have placed their working schedules on a five day basis.

The machine tool dealers report business to be "about the same," more inquiries coming in and improvement confidently expected in the fall. Special machines such as have been demonstrated to better the output of less modern tools are being asked for.

Cleveland

Ending of May finds the machinery industry in the Cleveland district in less of an encouraging position than it was at the beginning of the month. Depending, as it has for the last six months largely on replacement of equipment by automotive industry plants, the machinery trade itself faces what apparently will be a quiet summer.

Heavy duty equipment, lighter automatic equipment and other standard tools have again slumped from the spurt they attained at the beginning of the month. One brighter phase is offered by the planer interests, which report some fair response, especially from the middlewest territory.

Buffalo

One manufacturer in the Buffalo district reports a satisfactory business on punch and shear equipment of fairly large size, mostly going to iron working shops. However, this and other manufacturers report that business, considering all their lines, is spotty to say the best of it. Orders from municipalities and governmental sources are quiet, the railroads in general are buying little new equipment right now and jobbers are not stocking heavily on forges, drills or other smaller machines.

According to some of the machine tool dealers in the Buffalo district the New York Central, Pennsylvania and two or three other railroads are buying some equipment locally. Also, private shops which do railroad work are in the market for a limited quantity of small tools, such as portable electric drills and reamers.

One dealer reported the recent sale of three or four large lathes, and a number of small grinders. These sales and most of the business done through this particular office recently have been with medium size machine shops doing specialty work.

The general impression seems to be that should warmer weather set in soon there will be a pick up locally in automobile manufacturing and also the various automobile parts and accessory manufacturers located along Buffalo.

Detroit

Special jobs of all kinds are the order of the day in Detroit and its environs, with practically no two jobs alike, and executives in most instances preferring to take their chances with special machinery rather than standard equipment.

Featuring the past week has been the announcement of five new axle jobs. These, as well as a number of other developments, show a tendency among manufacturers to keep abreast of the time and to depend upon improvements and the quality of their products to increase their sales totals.

Automobile production has found little change during the past few days. Most plants are working on normal schedules. Allied lines report better prospects. The Wilson Foundry Co. of Pontiac resumed its work for the Overland plant Monday of this week, with a daily production of 550 jobs. Resumption of the work for the Willys-Knight is expected about June 1.

Philadelphia

While the industrial situation in Philadelphia does not present a bright outlook for the future, manufacturers in most lines hope for a clearing away of the present situation before long. Machinery manufacturers continue to experience a quiet period.

The hope for the future is based upon the knowledge that railroads have not purchased machinery in any extensive quantity for such a period that eventually business from this source will come. The labor cost having been advanced for so long the roads have been more economical in other lines, including the purchase of machine equipment. The roads have had their attention centered on other things, including terminal facility improvements and the restocking of machine shops has been deferred.

Philadelphia manufacturers learn that the Norfolk & Western Railroad Co. has a list of new equipment which it soon will put out.

Automobile dealers report a surplus of cars on hand which is the reverse of the usual situation for this season. The sale of automobile accessories fell off considerably during the last week. There is a large amount of second-hand machinery on the market, and many firms in this line have recently liquidated.

New York

There has been very little change in the machinery and machine tool markets in the New York district this week. The quietness that characterized business a week ago is still in evidence but with the hopes for the future brighter, according to the dealers. From reliable sources come the reports that railroads and automobile makers will be in the market for tools before another two weeks pass, and it is pointed out that, while the inquiries are fewer in number, they are greater in size than is usual.

A few railroad lists appeared during the week mostly from Southern railroads. The Norfolk & Western recently closed on a number of tools and other roads are expected to purchase this week. Single orders for special machines and heavy machinery were received from general industrials. Most of the orders being received are for replacements and not for expansions.

Used machinery sold well this week, although there was a slight decline from the business that has been done during the past month.

Machinery exports show a steady business; above that of last year with expectations for even better business during the summer months.

Cincinnati

Production of machine tools in Cincinnati during the month of May held up to about the same volume as was recorded during the previous month. The orders that have been placed have been fair, while the inquiries received are indicative of slightly better business in the near future. The automobile manufacturers are still exhibiting extreme caution in their purchases and are careful not to place orders except when necessary for immediate delivery. Business from this source, however, has increased slightly, but is below normal. The railroads have been more active in the local machine tool market during the past few weeks than at any previous time this year. Several roads have made purchases, while others have lists out and are expected to place business within the next ten days.

Lathes have been in fair demand with several large orders for engine lathes placed lately. Milling machines have had rather slow sales, but executives believe that they will be more

active because of the inquiries that have come in for them. Business on large grinders has improved somewhat and the volume of production in this field has benefited therefrom. Drilling machines, which have had a quiet market for a considerable period, are selling better and inquiries point to an increase in sales. Manufacturers of planers state that their business has held up well in the last month comparing most favorably with any previous month this year. Woodworking machinery continues to be in heavy demand and plants here are working at capacity to keep up with current orders. Conveying machinery production likewise has been splendid.

Gary Says Better Business Ahead

That the government proposed at the height of the war to take over the iron and steel industry and that the industry replied it would not calmly submit to nationalization was revealed by Elbert H. Gary at the dinner at the Hotel Commodore, which brought to a close the twenty-fifth general meeting of the American Iron and Steel Institute, of which he is the president.

Mr. Gary told this hitherto unpublished fact in outlining the activities and the accomplishments of the industry during the war. He did so, he said, that a permanent record might be made "in such shape that whatever might be said by any one, if contradictory to the facts, might be corrected by our records."

In opening the meeting at the morning session Mr. Gary spoke at length on his visit to South America. Next he spoke on business and political conditions. He said that while business was not altogether satisfactory, the country was not going into the hands of a receiver.

Other speakers at the dinner were Ambassador Honorio Pueyrredon of Argentina, Donald MacKinnon, Commissioner from Australia to the United States, and Axel Fredrik Walberg, president of the Swedish Iron Masters' Association.

Papers Read

On the morning program were Walter Mathesius of the Illinois Steel Co., whose topic was "Uniform Coking Coal as a Factor in Blast Furnace Economy"; Ernest T. Weir, Weirton, W. Va., on "Selling Practices of the Steel Industry," and Commander J. B. Rhodes, United States Navy, on "The Manufacture of Steel for Ordnance Purposes." At the afternoon session the speakers were Thomas T. Read of the United States Bureau of Mines, on "Composition of Raw Materials and Pig Iron Costs"; J. R. Adams of the Midvale Co., on "Hardened and Ground Rolls"; G. M. Hohl of the Bethlehem Steel Co., on "The Cleaning of Blast Furnace Gas" and Gordon Fox of Chicago, on "Power Consumed in Rolling Steel."

The spring meeting brought steel executives from all parts of the country to this city. Opinions expressed by these executives were less cheerful than those of a few months ago, due to the rapid falling off in new business, but on the whole confidence was expressed regarding the future, and most of the big producers were of the belief that the industry has touched "bottom" and that the next change will be for the better.

Business Items

The fourth annual sales school of the Link-Belt Co. was held in Indianapolis, Ind., May 5 to 8. Nineteen salesmen from all parts of the United States attended and addresses were made by Alfred Kauffmann, vice-president in charge of the Indianapolis works, and Julius S. Holl, advertising manager.

The Adams & Durkee Steel Co., Inc., 287 Atlantic Ave., Boston, Mass., has been appointed the sole selling agent and distributor for the United States for Arthur Balfour & Co., Ltd., the Thompson Wire Co., the Boston & Lockport Block Co., and the Wheeldon Wire Co.

Ludwig Hommel & Co., Pittsburgh representatives of the Wagner Electric Corp., St. Louis, Mo., have moved to 929 Penn Ave.

The New York office of the Vanadium Alloys Steel Co., Latrobe, Pa., has been moved to 270 Madison Ave.

Formation recently of the A. R. Robinson Machinery Co., First Ave. and Thirty-ninth St., Birmingham, Ala., as distributors of new and rebuilt machinery and tools in the southern field has been announced. A. R. Robinson, a veteran machinery distributor in the South heads the company, which succeeds Mr. Robinson's former business.

The Ohio Pattern Works & Foundry Co., Cincinnati, has acquired the property adjoining its present plant and plans are being made for the erection of a new building to take care of the expansion of the company's business.

The J. A. Fay & Egan Co., Cincinnati, manufacturer of woodworking machinery, celebrated its ninety-fifth anniversary during the past week when the company's plant was thrown open for the inspection of hundreds of visitors. The latest methods and devices in manufacturing advanced types of woodworking machinery were demonstrated.

A $1,000,000 plant for the manufacture of automobile parts, wheels, etc., is to be constructed this year at Baton Rouge, La. by the Mengel Co., of Louisville, Ky., the company having recently obtained a 100-acre site at Baton Rouge for the purpose. It will be finished within five months, according to H. B. Holtevert, manager of the plywood and panel department.

The Quick Adjustable Wrench Co., capitalized at $500,000, has been incorporated in San Francisco. The directors are: J. V. Belluomini, A. L. Lucot, W. M. Whittenberg, L. S. Fraser and T. G. Negrich.

Obituaries

Robert Wuest, formerly commissioner of the National Metal Trades Association, died at Atlantic City, May 16. He was sixty years of age and had been in poor health for several years. Mr. Wuest was born in Cincinnati and after working his way up with the firm that he started his industrial career with, he retired and became secretary of the Cincinnati branch of the National Metal Trades Association. In 1903 he became commissioner for the association with headquarters in Cleveland and continued in that position for the next ten years. Due to his failing health Mr. Wuest tendered his resignation in April, 1913, and it was regretfully accepted by the Metal Trades Association.

Frank C. Caldwell died recently, while on his way from his home to the Oak Park Trust & Savings Bank, Chicago, of which he was president. He was the active head of the H. W. Caldwell & Son Co. for many years until this company was bought by the Link-Belt Co. He was twice elected president of the National Metal Trades Association and subsequently served for ten years as its treasurer.

H. A. Winans, aged 62 years, died recently at his home in Cincinnati. He was the assistant treasurer of the American Laundry Machinery Co., Cincinnati.

Personals

Harold C. Smith, president of the Illinois Tool Works, Chicago, immediately after completing arrangements for the erection of his new factory, sailed for Europe on a combination business and pleasure trip. He will return in July.

Dr. Otto P. Geier, of the Cincinnati Milling Machine Co., Cincinnati, has been appointed president of the executive committee of the Cincinnati Safety Council which was recently organized.

George E. Merryweather, president of the Motch & Merryweather Machinery Co., Detroit, has returned from Cuba.

George R. Hine has become factory manager of the New Process Twist Drill Co., Taunton, Mass. He was formerly general superintendent of the Whitman & Barnes Manufacturing Co., Akron, Ohio.

George L. Gaylord, for many years treasurer of the Vitrified Grinding Wheel Co., Westfield, Mass., has become president of the recently organized Westfield Grinding Wheel Co., Westfield, Mass.

William T. Read has been elected treasurer of the Morse Twist Drill & Machine Co., New Bedford, Mass. He succeeds the late Herbert E. Cushman.

G. M. WILLIAMS, president of the Wire Wheel Corp., Buffalo, has been elected president of the Nordyke & Marmon Co. of Indianapolis.

F. W. MCINTYRE has been elected vice-president of the Reed-Prentice Co., Worcester, Mass.

S. H. MARCH has joined the staff of Alfred Herbert, Ltd., Coventry, Eng., and will be interested in the importing and factoring department. Mr. March was formerly director and general manager of the Churchill Machine Tool Co., Ltd., Broadheath, Manchester, Eng., and was also for several years manager for Charles Churchill & Co. in Lancashire and Yorkshire.

GEORGE M. DIEHL, president, and R. J. LAWELL, vice-president of the George M. Diehl Machine Works at Wabash, Ind., recently were hosts to sales representatives of the plant from all parts of the United States.

L. D. ALBIN, formerly general sales manager of the Ingersoll-Rand Co., 11 Broadway, New York City, has been elected vice-president in charge of European sales of that company. D. C. KEEFE, formerly assistant general sales manager, has been appointed to succeed Mr. Albin as general sales manager.

W. L. SULLIVAN has been appointed Oklahoma representative for the Diamond Power Specialty Corp. of Detroit, Mich. His headquarters will be at 505 Central National Bank Building, Tulsa, Okla.

CHARLES H. HALLE has joined S. F. Bowser & Co., Fort Wayne, Ind., as a mechanical engineer engaged in methods work. He was formerly methods engineer for the Huck Axle Corp., Chicago, Ill.

W. E. ADAMS, formerly sales manager of the Edgar T. Ward's Sons Co., has severed his connection with that company and organized the Adams & Durkee Steel Co., Boston, of which he is president.

W. G. WEBSTER, formerly with the Maxwell Motor Corp. in Detroit, is now superintendent of maintenance at the Bay City plant of the C. R. Wilson Body Co.

FREDERICK E. WRIGHT has become connected with the sales department of the International Oxygen Co. of Newark.

CHARLES O. CRUMP is now connected with the Enterprise Wheel & Car Corp., Bristol, Tenn.

W. B. DURKEE, for many years a mill agent in Boston, has become a member of the firm of the Adams & Durkee Steel Co., Boston, Mass., as treasurer.

J. CHARLES HOOPER, who was sales engineer for the Cincinnati Ball Crank Co., Cincinnati, to the car manufacturers for a number of years prior to 1919, has returned to take charge of the eastern territory on Balcrank bumper sales.

G. ROBERT OSGOOD, for many years with the Edgar T. Ward's Sons Co., has resigned to become vice-president of the Adams & Durkee Steel Co., Boston, Mass.

Conference Board Holds Annual Meeting

Business leaders from all parts of the United States to the number of several hundred assembled in New York on Thursday, May 15, to discuss the latest trends in industry, at the annual meeting and dinner of the National Industrial Conference Board. The members and guests of the board, which occupies headquarters at 247 Park Ave., were addressed in the evening at the Hotel Astor by Dr. Nicholas Murray Butler, president of Columbia University, on "The Relation of Government to Private Business Enterprise."

"The Legal Status of Trade Associations" was discussed by Dr. I. L. Sharfman, nationally-known economist, of the board's staff. "The Constructive Functions of Trade Associations" was the topic of Fayette R. Plumb, a prominent manufacturer of Philadelphia, and Franklin D. Jones, a well-known lawyer of Washington. "The Collection and Dissemination of Trade Information" was the theme of Wilson Compton of Washington, manager of the National Lumber Manufacturers' Association. Brief discussion by others present followed.

Westinghouse Earnings Increased

The Westinghouse Electric & Manufacturing Co. reports net earnings of 18 per cent on the preferred and common stock for the year ended March 31, or $8.98 per share on the aggregate $89,775,150 stock outstanding during the year. In 1922 the company earned approximately 16 per cent on $74,812,650 of stock, or at the rate of $8.19 a share. For the last year net income available for dividends totaled $16,125,303, against $12,263,286.

Although no mention of the company's radio business was contained in the annual report, General Guy E. Tripp, chairman of the board, stated that it represented between 6 and 7 per cent of the total manufacturing activity.

Ford Not Making Any Profit on Cars

On a business which has grown to a billion dollars a year in 20 years the Ford Motor Co. is now selling automobiles practically at cost, according to the *Wall Street Journal*.

Profits now come from parts sales, freight charges, sale of by-products, interest on bank balances and securities. In other words, the company's most recent financial statement indicates that the program of increasing output to lower costs has reached the point of diminishing returns.

This is a big change from conditions two years ago, when the bulk of profits came from car sales. Even as recently as in the twelve months which ended with Feb. 28, 1923, the sale of new cars netted $56,000,000 of the $119,000,000 profits. In the year closed Feb. 29, 1924, profits from car sales were but $3,930,483 of the $82,263,483 total. The remaining $78,150,000 was made up of gains from parts sales, interest, etc.

While these calculations are necessarily approximations, they show the trend. Ford fought his way out of difficulties in 1921 by converting semi-finished stocks into cars and forcing them onto the market; by reducing transit time of shipments, and by slashing overhead.

In the present situation Mr. Ford undoubtedly has a trump card up his sleeve with which to turn the trend of profits without lowering wages or increasing car prices.

Societies in Buffalo Elect Officers

Officers elected by the American Society of Mechanical Engineers, Buffalo section, Friday, May 23, are as follows: Chairman, F. B. Hubbard, McCarthy Brothers & Ford; vice-chairman, J. W. Gidney; secretary, C. G. Kaelin, the Commercial Body & Hoist Co.; treasurer, William M. Dollar, manager the Warsaw Elevator Co.; committeeman, Donald F. Potter, the Robertson-Cataract Co.

The following officers have been elected by the Engineering Society of Buffalo: President, W. J. Gamble, Jr., the Vulcan Drop Forge Co.; vice-president, R. G. Nye, the Buffalo Steam Pump Co., Tonawanda; secretary, Roswell Farnham, the Buffalo Forge Co.; treasurer, B. A. Hansen, manager Buffalo office, the Cutler Hammer Co.; directors, T. W. Barrally, city engineer, Tonawanda, N. Y., and J. F. Guider, works manager the Pierce Arrow Motor Car Corp.; executive secretary, J. R. Owen.

Forthcoming Meetings

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

Gas Products Association. Tenth annual meeting. June 10, 11 and 12. Ambassador Hotel, Atlantic City, N. J. C. T. Price, secretary and treasurer, 140 S. Dearborn St., Chicago, Ill.

The General Committee of Division V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

American Society for Testing Materials. Twenty-seventh annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Week of June 23. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

Society of Automotive Engineers. Summer Meeting. June 24, 25, 26 and 27. Spring Lake, N. J. C. F. Clarkson, secretary, 29 W. 39th St., New York City.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Foundrymen's Association. Twenty-eighth annual convention. Milwaukee, Wis. Week of Oct. 13, 1924.

Management Week. Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron inquiries more frequent. Sales of No. 2 f'd'y iron nearer $22 than $23 per ton, f.o.b. Birmingham. Iron and steel scrap prices advancing. Steel market improved in tone. Demand for steel sheets, bars and tin plate better. Mill price of steel pipe firm at present levels. Steel shapes still quoted at $2.10@$2.25 per 100 lb. at mill; plates, $2@$2.25 and bars, $2.20@$2.25, f.o.b., Pittsburgh.

Non-Ferrous Metals—Antimony is the only non-ferrous metal to show firmness in the present market; price advanced ¼c. per lb. in New York since May 16. Bottom believed to have been reached in copper market. Downward trend in tin reflects decline abroad. Lead weak; market down $7 per ton, May 22. Zinc demand limited.

(All prices as of May 23)

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22@23
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	$2.80@3.00	4.34	3.65	4.00
No. 12	2.90@3.10	4.39	3.70	4.05
No. 14	3.00@3.20	4.44	3.75	4.10
No. 16	3.20@3.40	4.54	3.85	4.20
Black				
Nos. 17 and 21	3.70	4.65	4.35	4.55
Nos. 22 and 24	3.75	4.70	4.40	4.55
Nos. 25 and 26	3.80	4.75	4.45	4.60
No. 28	3.85	4.85	4.55	4.70
Galvanized				
Nos. 10 and 11	3.80@4.00	4.90	....	4.60
Nos. 12 and 14	3.90@5.10	5.00	....	4.70
Nos. 17 and 21	4.20@4.40	5.30	....	5.00
Nos. 22 and 24	4.35@4.55	5.45	5.10	5.15
Nos. 26	4.50@4.70	5.55	5.35	5.30
No. 28	4.80@5.00	5.85	5.65	5.60

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0.09	50%	⅞	$0.16	35%
⅝	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.40
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	4.10	4.00
Cold drawn flats, squares	4.90	4.60	4.50
Structural shapes (base)	3.59	3.46	3.30
Soft steel bars (base)	3.49	3.36	3.20
Soft steel bar shapes (base)	3.49	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.59	3.46	3.30
Bar iron (3.00 at mill)	3.49	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	60%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.25
Tin, 5-ton lots, New York			41.00
Lead (up to carlots), St. Louis	6.85	New York	7.50
Zinc (up to carlots), St. Louis	5.65	New York	6.50

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.00	30.00	28.50
Antimony (Chinese), ton spot	9.00	10.75	10.00
Copper sheets, base	20.25	20.25@20.50	23.00
Copper wire, base	15.50	18.25	16.25
Copper bars, base	19.25	21.50	19.50
Copper tubing, base	22.25	26.50	23.00
Brass sheets, base	16.75	21.00	18.75
Brass tubing, base	21.00	26.00	20.50
Brass rods, base	14.50	17.00	15.75
Brass wire, base	17.25	21.00	....
Zinc sheets (casks)	10.75	10.75	....
Solder (½ and ½), (case lots)	34.75	30.00	30.00
Babbitt metal (83% tin)	60.00	53.00	48@52
Babbitt metal (35% tin)	28.00	17.50	23@26
Nickel (ingot and shot) f.o.b. refinery	27.00	....	....
Nickel (electrolytic) f.o.b. refinery	30.00	....	35.00
Nickel (F shot) f.o.b. refinery	30.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54. 00
Manganese nickel hot rolled rods "D"—high manganese (base) 57. 00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32. 00	Hot rolled rods (base)	40. 00
Blocks	32. 00	Cold drawn rods (base)	48. 00
Ingots	38. 00	Hot rolled sheets (base)	42. 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00@10. 75	10. 50	10. 75
Copper, heavy, and wire	9. 62½@10. 50	10. 00	10. 00
Copper, light, and bottoms	8. 50@ 9. 00	8. 50	9. 00
Lead, heavy	5. 62½@6. 00	6. 00	6. 50
Lead, tea	4. 37½@5. 00	3. 50	5. 50
Brass, heavy, yellow	6. 50		6. 50
Brass, heavy, red	8. 50 @8. 75	9. 00	8. 50
Brass, light	5. 75	5. 00	6. 00
No. 1 yellow brass turnings	6. 50 @6. 75	6. 00	6. 50
Zinc	3. 50 @3. 75	3. 50	3. 50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$24. 30	$22. 85	$18. 50
"A" Grade:				
IC,	20x28, 112 sheets	20. 20	18. 00	17. 00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14. 00	13. 00	14. 50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8. 25	6. 55	7. 40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 14@0. 21	$0. 20	$0 14
Cotton waste, colored, per lb.	.09@ .12½	.17	. 10½
Wiping cloths, 13¼x13¼, per lb	11. 50	36. 00 per M	. 16
Wiping cloths, 13¼x20½, per lb.	....	52. 00 per M	. 16
Sal soda, per 100 lb.	2. 40	2. 25	2. 65
Roll sulphur, per 100 lb.	3. 60	3. 25	3. 50
Linseed oil, per gal., 5 bbl. lots	. 98	1. 07	. 94
Lard cutting oil, 25% lard, per gal.	. 55	. 50	. 79*
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	. 35	. 40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber and duck:			
First grade	50%	50–10%	40–10%
Second grade	50–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$5. 40	$5. 84	$6. 48
Emery paper	9. 90	11. 00	8. 80
Emery cloth	31. 12	31. 12	29. 48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1. 49	1. 24	1. 40
Cloth	3. 38	2. 67	3 20
Fire clay, per 100 lb. bag	....	. 65	. 60
Coke, prompt furnace, Connellsville	per net ton		3. 75@4. 00
Coke, prompt foundry, Connellsville	per net ton		4. 75@5. 50
White lead, dry or in oil	100 lb. kegs	New York, 15. 00	
Red lead, dry	100 lb. kegs	New York, 15. 00	
Red lead, in oil	100 lb. kegs	New York, 16. 50	

*Chicago quotes on pure lard oil, No. 1 grade.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0349	$0.0349	$0.0354
Cold finished shafting	per lb.	0.044	0.044	0.044
Brass rods	per lb	0.145	0.155	0.1875
Solder (½ and ½)	per lb.	0.3475	0.39	31.50@33.50
Cotton waste	per lb.	.14@.21	.14@.21	.10@.13
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.60
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	50%	45%	30%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	60–10–5%	55–5%
1½ and 1¼x3 in. up to 12 in	15%	60%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	35%	$3. 50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	3. 50 net	$4. 00 off
Button head bolts, with hex. nuts	List net	List net	3. 50
Hex. head and hex. nut bolts	List net	.....List plus 10%	
Lag screws, coach screws	50%	.....	50–5%
Square and hex. head cap screws	75%	75%	75–5%
Carriage bolts, up to 1 in.x30 in.	40%	60%	50–5%
Bolt ends, with hot pressed nuts	50%	.....	55-5%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, ⅜ and smaller	70%	.....	.....
Semi-finished nuts, ⅜ and larger	65%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6. 50	$4. 00	$4. 00
Washers, cast iron, ⅝ in., per 100 lb. (net)	5. 50	4. 00	4. 00
Washers, round plate, per 100 lb. Off list	1. 50	4. 50	4. 00
Nuts, hot pressed, sq., per 100 lb. Off list	1. 50	4. 00	3. 50
Nuts, hot pressed, hex., per 100 lb. Off list	1. 50	4 00	3. 50
Nuts, cold punched, sq., per 100 lb. Off list	1. 50	4. 00	3. 50
Nuts, cold punched, hex., per 100 lb. Off list	1. 50	4. 00	3. 50
Rivets:			
Rivets, ⅞ in. dia. and smaller.	50%	60–10%	60%
Rivets, tinned	50%	60–10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5. 00	$3. 50	$3. 75
Cone heads, ditto (net)	5. 20	3. 60	3. 95
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0. 25	.....	0. 15
⅝ in. diameter *EXTRA*	0. 35	.....	0. 15
½ in. diameter *EXTRA*	0. 75	.....	0. 50
1 in. long, and shorter *EXTRA*	0. 75	.....	0. 50
Longer than 5 in. *EXTRA*	0. 50	.....	0. 25
Less than 200 lb. *EXTRA*	0. 50	.....	0. 50
Countersunk heads *EXTRA*	0. 45	.....	$4. 20 base

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ill., Mendota—Mendota Mfg. & Transfer Co. (machine shop), J. Schalb, Genl. Mgr. —millers and lathes.

Md., Baltimore—A. K. Robins Co., 116 Market Pl. (manufacturer of canning machinery, etc.), R. A. Sindall, Pres.—equipment for boiler and engine repair shop, later.

Mass., Hyde Park (Boston, P. O.)—M. Schwalb, 3 Dana Ave.—equipment for proposed machine and repair shop.

Mich., Highland Park (Branch of Detroit) —Ford Motor Co.—about $100,000 worth of tools for proposed addition to assembly plant at Oklahoma City, Okla.

Miss., Jackson—Amer. Box & Lumber Co. —300 hp. engine and generator; two fast feed, winch head planers and matchers (foregoing used); 4,000 4 ft. kiln trucks with 8 in. wheels.

N. Y., Buffalo—J. O. Carey, 2050 Niagara St.—machinery for pattern shop.

N. Y., Buffalo—E. S. Francis, 49 Georgeton St.—equipment for cabinet shop.

N. Y., Buffalo—J. G. Scheidweiler, 115 East Tupper St.—equipment for automobile repair shop.

O., Columbus—E. A. Prentice Co., Vine and Armstrong Sts.—30 in. planer, 12 in. molding machine and other woodworking machinery.

O., Mansfield—All Metal Casket Co., G. S. Heck, Mgr.—metal working machinery for new factory.

Okla., Oklahoma City—Sherman Machine & Iron Wks. Co., 32 East Main St.—sheet presses, drills and drop forging equipment for proposed addition to plant.

Okla., Tulsa—Slater Bros., 60 North Gilette St.—compressor, drill presses and drop forging plant.

S. C., Conway—Veneer Mfg. Co., W. A. Stilley, Treas.—24 or 26 in. x 10 or 12 ft. machinists lathe and drill press.

Wis., Cudahy—Odry Bros., 1211 Packard Ave., L. Odry, Purch. Agt.—6 ft. lathe, boring machine and emery grinder.

Wis., Franklin (Plymouth, P. O.)—W. Long—sheet metal working machinery.

Wis., Kiel—Rudolph Greve Co.—sheet metal working machinery.

Wis., Milwaukee—Central Bd. of Purchases, City Hall—large milling machine.

Wis., Milwaukee—Grover Co., c/o R. Grover, 3222 Mount Vernon Ave.—lathe and drill press.

Wis., Milwaukee—School Bd., 10th and Prairie Sts., E. Schroeder, Purch. Agt.—K. & T. Universal milling machine with parts; motor driven drill press with compound table; Johnson heat treating furnace; vises.

Wis., Stoughton—Gjerston Bros. Co.—machinery and equipment for new machine and repair shop.

Ont., Huntsville—S. T. Hinten—machinery, etc., for boat building plant.

Ont., Sprucedale—G. Dumberline—equipment for sawmill.

Opportunities for Future Business

Conn., Hartford—The Colling Tool & Machine Co., Asylum St., is having plans prepared for the construction of a 1 story, 50 x 100 ft. machine shop. Greenwood & Noerr, Main St., engrs.

Ga., Dublin—The Wrightsville & Tennille R.R. Co. plans to build a repair shop, here. C. Molony, Pres.

Ill., Galesburg—The Chicago, Burlington & Quincy R.R., 547 West Jackson Blvd., Chicago, awarded the contract for the construction of an 80 x 216 ft. steel car repair plant, here. Estimated cost $200,000. Noted Mar. 6.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

Everything possible is done to insure authenticity and timeliness.

Your co-operation is invited in helping us maintain th s service at the highest efficiency.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

Ill., Mendota—The Mendota Mfg. & Transfer Co. is building a 40 x 100 ft. machine shop for the manufacture of farm implements and specialties. J. Schalb, Genl. Mgr.

Mass., Hyde Park (Boston, P. O.)—M. Schwalb, 3 Dana Ave., is having plans prepared for the construction of a 1 story, 20 x 70 ft. machine and repair shop. A. Rosenstein, 7 State St., Archt.

Mass., Jamaica Plain (Branch of Boston) —The City School House Dept., 103 City Hall Annex, Boston, plans to build a 2 story, 80 x 110 ft. and 3 story, 40 x 168 ft. addition to school, including metal and woodworking departments, here. Estimated cost $400,000.

Mass., Pittsfield—The General Electric Co. awarded the contract for the construction of a 1 story, 90 x 400 ft. addition to its plant for the manufacture of transformers.

Mass., Woburn—C. De Rosa, Salem St., is receiving bids for the construction of a 2 story, 40 x 100 ft. showroom and machine repair shop. Estimated cost $40,000. E. R. B. and A. C. Chapman, 101 Tremont St., Boston, Archts. Reo Motor Co. lessee.

Mich., Fenton—The Fenton Machine Tool & Die Co., manufacturer of dies, jigs, fixtures, special machinery and stampings, plans to build a 90 x 180 ft. plant. Estimated cost $40,000. H. Glaspie, Purch. Agt.

Mich., Milan—The Amer. Boiler & Fdry. Co., manufacturer of heating boilers, plans to build an 80 x 200 ft. factory. Estimated cost $28,000.

Miss., Jackson—The Amer. Box & Lumber Co. is having plans prepared for the construction of a plant on a 20 acre site. Estimated cost $150,000. G. W. Newton, 425 Edwards Hotel Bldg., Engr.

N. Y., New York—Dept. Plant & Structures, Municipal Bldg., awarded the contract for the construction of a housing station on 139th St. and Harlem River. Estimated cost $648,800.

N. Y., New York—B. Zinick, 965 Putnam Ave., Brooklyn, will build a 7 story, 100 x 150 ft. garage on West 134th St., here. Estimated cost $600,000.

O., Cleveland—The White Sewing Machine Co., 7821 St. Clair Ave., awarded the contract for the construction of a 4 story, 100 x 100 ft. factory on Winslow St. Estimated cost $200,000. W. T. White, Pres.

O., Cleveland—The Willard Storage Battery Co., c/o P. H. Voth, Engr., East 131st St. and St. Clair Ave., awarded the contract for the construction of a 4 story, 40 x 100 ft. factory. Estimated cost $100,000. Noted Mar. 27.

O., Columbus—The Stitt Ignition Co., 16 East 1st Ave., manufacturer of spark plugs, awarded the contract for the construction of a 1 story, 35 x 160 ft. addition to its factory. Estimated cost $15,000.

O., Geneva—The Champion Hardware Co. awarded the contract for the construction of a 3 story factory to contain 26,000 sq.ft. of floor space. Estimated cost $125,000. Noted Mar. 6.

Okla., Oklahoma City—The Ford Motor Co., Highland Park (Branch of Detroit), Mich., awarded the contract for the construction of a 3 story, 125 x 140 ft. addition to assembly plant at 900 West Main St., here. Estimated cost $150,000.

Okla., Oklahoma City—The Sherman Machine & Iron Wks. Co., 32 East Main St., plans to build a 2 story addition to its plant. Cost from $25,000 to $40,000.

Okla., Tulsa—Slater Bros., 60 North Gilette St., plan to build a plant for the manufacture of derricks, rigs and oil well supplies. Estimated cost $125,000.

Pa., Phila.—F. C. Holberg, 1011 Chestnut St., manufacturer of elevator safety interlocks, awarded the contract for the construction of a 2 story, 45 x 67 ft. shop on 13th and Hamilton Sts.

Pa., Phila.—The Moore Push Pin Co., Berkley St. between Wayne Ave. and Greene St., will soon award the contract for the construction of a 1 story, 60 x 125 ft. addition to its factory. Estimated cost $35,000. Ballinger Co., 12th and Chestnut Sts., Archts.

Pa., Phila.—The Wirt & Knox Mfg. Co., 23rd and York Sts., manufacturer of hose reels, awarded the contract for the construction of a 2 story, 94 x 95 x 147 ft. plant. Estimated cost $75,000.

Tex., Houston—The Southern Pacific R.R., Southern Pacific Bldg., is receiving bids for the construction of car repair shops at Englewood Yards. Estimated cost $500,000. J. H. Hull, Ch. Engr.

Tex., Houston—The Thompson-Katz Lumber Co., West Bldg., plans to build a sawmill at Camp Logan. Estimated cost $50,000. Engineer or architect not announced.

Tex., Weatherford—The Milmo Lumber Co. plans to build a planing mill, etc. Estimated cost $100,000.

Wis., Milwaukee—The Smith Eng. Wks., 1154 32nd St., manufacturer of stone crushing machinery, plans to build a 1 story factory on Lake St. Estimated cost $50,000 or more. H. Smith, Secy. Engineer or architect not selected.

Ont., London—The Caloric Furnace Mfg. Co., 691 Bathurst St., plans to build an addition to its plant. Estimated cost $25,000. S. J. Shibley, Mgr.